PHILIPPINE
GOVERNMENT
LABORATORIES

REPORT

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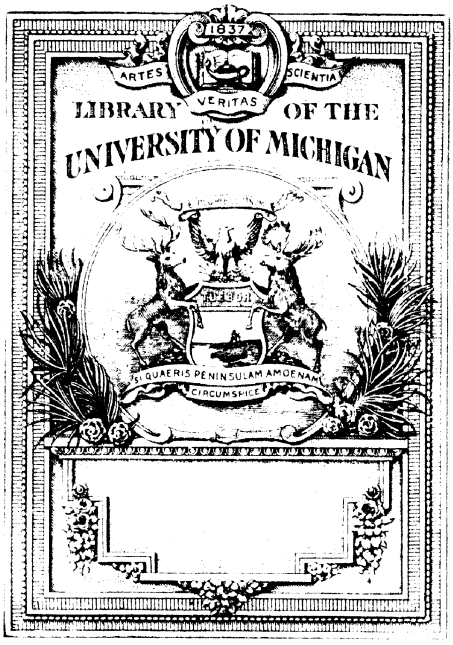
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REPORT

OF

GOVERNMENT LABORATORIES OF THE PHILIPPINE ISLANDS

FOR THE

YEAR ENDED AUGUST 31, 1902.

(FROM THE REPORT OF THE PHILIPPINE COMMISSION.)

BUREAU OF INSULAR AFFAIRS,
War Department.

APPENDIX M.

REPORT OF THE SUPERINTENDENT OF GOVERNMENT LABORATORIES FOR THE YEAR ENDING AUGUST 31, 1902.

MANILA, P. I., *September 11, 1902.*

Hon. DEAN C. WORCESTER,
Secretary of the Interior, Manila, P. I.

SIR: In accordance with your request dated August 28, I have the honor to transmit herewith the "Annual report of the bureau of government laboratories," covering the period from the date of its organization to September 1, 1902.

ORGANIZATION.

On June 20, 1901, I received a cablegram from the secretary of the interior appointing me superintendent of government laboratories, which post was accepted on the following day, with the understanding that the position was to be taken by me during leave of absence from the University of Michigan.

In accordance with instructions, I visited a number of laboratories in the United States with which I was not familiar, especially in the cities of Washington, New York, and at Woods Hole, Mass., with the purpose of discovering available candidates for future positions and obtaining information not already on hand, to be used for the equipment and library of the Philippine laboratories. While engaged in these visits I also carefully compiled the lists of journals and manuals absolutely necessary for the beginning of a scientific library, and by consultation with a number of experts in work lying in fields outside of my own I also learned as much as possible in regard to the purchase of supplies in those branches with which I was not intimately familiar, and obtained a stock of catalogues of laboratory apparatus. With this equipment I left San Francisco on August 21, 1901, and reached Manila September 25, 1901.

Such government laboratories as existed in the Philippine Islands had been organized under the title of the "Municipal laboratory of Manila," in charge of Dr. W. J. Calvert, who had left for the United States before my arrival, and at the time of the actual organization of the government laboratories, there were present the following force: Irving C. Allen, chemist; Mariano Vivencio, assistant chemist; Dr. James W. Jobling, detailed from the Hospital Corps for biological work; Eizmendi Braulio, curator; Julian Bernal, laborer.

The small stock of apparatus and chemicals and the very meager library were stored on the ground floor of the building which had been rented for the use of the civil hospital, and no actual work was done for at least six weeks prior to my arrival, as the laboratories had been compelled to move from their previous quarters.

The first undertaking was to obtain some temporary building for laboratory purposes, as there were a number of analyses and bacteriological determinations which had been of necessity laid aside, and, after due consideration, the small building in the rear of the civil hospital at No. 781 calle Iris was rented and the necessary fixtures installed. As soon as possible orders were sent to America and Germany for the absolutely necessary journals and for such apparatus as could be accommodated in the laboratory space available.

As act 156 contemplated the planning and erection of a new laboratory structure, it was not deemed advisable to incur any great expense in connection with the temporary quarters, especially as it was hoped to be able to occupy the new building in the course of the next year. The lease of No. 781 Calle Iris was completed October 1, and by October 15 the laboratories were in a position to under-

take certain kinds of routine work, such as the analysis of materials submitted by the custom-house, diagnostic analyses of urines for hospitals and physicians, and bacteriological examinations, and as soon as possible a circular to this effect was issued to the bureaus interested. From the beginning the board of health, custom-house, civil hospital, and the courts availed themselves of the opportunity offered, and the laboratory force found itself constantly busy with routine work.

The presence of plague in Manila and the attempted extermination of the rats by the board of health also soon brought upon the laboratory the duty of the diagnosis of all rats suspected of infection. The results of this work are appended in a special report.

Dr. R. P. Strong, director of the biological laboratory, reached Manila on January 1, and with his arrival the direction of all of the biological work was undertaken by him. An addition was now built to accommodate the government photographer, and another to give additional space for the biological and chemical work, and during the year the laboratory force has been augmented, until it now has the following employees: P. L. Sherman, chemist and investigator; Irving C. Allen, chemist; Charles L. Bliss, physiological chemist; Paul L. Stangl, analytical chemist; John H. Thigpen, assistant chemist; Mariano Vivencio, assistant chemist; Norman E. Williamson, assistant biologist; Moses T. Clegg, assistant bacteriologist; Charles Martin, photographer; H. S. Peabody, stenographer and clerk; Mary Polk, stenographer; Epifanio Saguil, clerk; Julian Bernal, janitor; Juan Diego, Silbino Peño, Gabino Rontaso, Simon de Garcia, Antonio Pecho, Sabino Baiguin, Nozario Lunabas, laborers.

The present quarters, in spite of every effort to make the best of the material on hand, are entirely inadequate for any extended work, and, as a consequence, the details for a new structure, together with those for the necessary equipment, have been pushed as rapidly as possible. Sketch plans of a suitable building were prepared by the superintendent of government laboratories and submitted to the bureau of architecture. The delay in properly equipping the latter bureau necessarily retarded the elaboration of these drawings, but active building operations were not interfered with in consequence, because the length of time required to procure a title to the land to be occupied by the new structure exceeded that needed for the completion of the plans. The drawings presented by the government architect embody all of the details needed to construct and thoroughly equip a modern laboratory and, by cooperation between the bureaus of government laboratories and architecture, a result has been produced which will be a credit to the Philippine Islands when completed, and which will enable all kinds of work to be carried on.

Plans of Laboratory Building.

The new building is planned to provide laboratory space for the chemical and biological laboratories and the serum institute. In order to accommodate all lines of work necessary in the Philippine Islands, the building will be divided into 60 rooms.

The plan of separating each class of work from the others was adopted after mature consideration and for the following reasons: The laboratory is not intended as an institution for instruction; consequently large rooms, capable of accommodating students, are not necessary. It is considered good policy in some laboratory plans to unite several smaller rooms into one, throwing a larger number of workers together for the purposes of contact of work and the exchange of views. While this would seem to be very advisable in the construction of laboratories in which all of the workers are not fully trained, it is not advantageous in a building where the laboratory work is so largely technical and where each line can be sharply differentiated and assigned to certain well-equipped employees. Each class of work will then have a separate space allotted to it and will not interfere with the other lines being carried on. The additional expense of building partitions is not great and the loss of floor space is nothing. Government work in a building planned after the design of the new laboratory can be conducted efficiently and with no interference between the various branches.

The chemical laboratory, experience has shown, must, in the Philippine Islands, provide space for the analysis of minerals, mineral products and rocks, of water, soils, food products, paints, oils, beverages, and other materials. In addition, it is necessary to investigate the natural resources of the islands and discover means of improving the products and, if possible, to develop new resources and industries. With this end in view, rooms must also be provided for distillation, for the examination of plant products, and for work in pharmacology, so that the

actual value of supposed medicinal plants can be decided on the spot where materials are at hand and fresh.

The routine work of the biological laboratory involves diagnostic analysis, bacteriological and otherwise, for the various hospitals, municipal physicians, board of health, police force, and other government institutions as may have occasion for such services. As this work is quite extensive, considerable space must be allowed for bacteriological diagnosis. The investigation of tropical diseases and the pathological changes brought about by them, both in human beings and in domestic animals, requires the construction of several rooms for the study of their causation and to accommodate pathology and physiology. The plans of the laboratories have been drawn so as to accommodate all of the work within one building, one-half of which will be occupied by the chemical and the other half by the biological laboratory, with store rooms and photographer's rooms held in common.

The necessary floor space is given by a building 216 feet long and 60 feet wide, having two stories. The laboratory desks are all to be provided with gas and water and, where necessary, with steam and vacuum. Each room is also to have a hood under which work either with noxious or dangerous chemical substances or with bacteriological products which need isolation may be carried out. The ventilation for these hoods is to be provided by fans.

The desk space, the number of sinks, water, gas, steam, and vacuum taps have been calculated, so as to accommodate a number of workers sufficient to meet the needs of the government for many years to come, and in locating the laboratory fixtures as much attention as possible has been paid to economy of space and construction consistent with good workmanship and convenience. Nothing has been added which, judging by present indications, will not be absolutely necessary for the carrying on of some line of work or investigation.

The condition of the weights and measures in the Philippine Islands has demonstrated the necessity of some institution in which standards of weights and measures can be adjusted, and, with this end in view, a portion of the ground floor of the chemical wing has been set aside for a physical laboratory which will be equipped for gravimetric, volumetric, thermometric, and photometric work and for electrical measurements. This institution would practically constitute a bureau of weights and measures for the islands and it will also afford a physical laboratory for the necessary investigations connected with the chemical work carried on in the other rooms of the building.

The power to light this building, and to furnish vacuum, steam, and water to the desks, and to supply the various motors which will be needed for the laboratory machines is to be provided by a 75-horsepower boiler and at present by one 35-kilowatt dynamo. This plant is deemed adequate, at present, not only to take care of the laboratories, but also of the other government structures which may be built in the neighborhood. The boilers and engines are to be housed in an addition 115 feet long and 68 feet wide to be built in the rear of the laboratory structure proper, and in this addition space has also been found for the laboratory of the serum institute and for the refrigerating room necessary for the preservation of serums and prophylactics and such chemicals and supplies as need to be stored in the cold. The capacity of the serum institute will be such as to supply the entire archipelago.

It has not been deemed advisable to include animal rooms in the building proper, because ground is at hand on which to isolate the animals and avoid the unpleasant features usual in laboratories where space is crowded. Two houses for the accommodation of small animals are to be built in the rear of the laboratory building, one of which will be for the use of the laboratory proper and the other for the serum institute. The construction will be such as to present conditions under which the animals can breed and multiply. This will enable the laboratories to keep a constant and sufficient supply on hand, a matter with which much difficulty is connected at present. The larger stables, necessary for the serum and vaccine institute, will be constructed farther to the rear and be planned upon modern hygienic principles. When the building is completed it certainly will provide facilities which will render the scientific work contemplated in the Philippine Islands independent of outside assistance.

The details of the building have been planned by Mr. E. K. Bourne, and will be discussed in the report of the bureau of architecture.

Facilities Afforded Investigators from Abroad.

In planning the new laboratory building and in purchasing apparatus, an important circumstance, adding to the value of the laboratories for the Philippine government, has been kept in mind. It is believed that the fertility of the field

for the investigation of tropical diseases and of chemical problems which can only be carried out here, will offer a great attraction to scientific men of high standing. Of late years the desire for the development of science in the Tropics has grown among the thoroughly trained men in the laboratories both of Europe and America, but the facilities for investigation have heretofore been furnished chiefly by equipping and organizing expeditions, the outfit of which must necessarily be limited, owing to the large cost of supplying temporary laboratories, and to their migratory nature.

These drawbacks to thorough work would be eliminated provided the Philippine government laboratories could supply facilities and room for such scientific expeditions, and it is thoroughly believed that as soon as the announcement of the complete equipment of the institution is made it will be possible, for limited periods, to draw on the best research talent in the world, without any greater expense to the government than the cost of transportation, and possibly of the living expenses of the men while here. The result of such investigations would be of inestimable value to the islands, and by the means proposed the services of men who otherwise would not possibly think of coming without large salaries or without an expensive allowance for the equipment of an expedition, can be secured. The plans of the insular architect will show the location and character of the rooms set aside for this class of work.

The Reference Library.

A necessary feature of scientific investigation is an adequate reference library, and it goes without saying that the bureau of government laboratories must be equipped with such an adjunct to work. The building plans have reserved a space in a central location which will be capable of easily accommodating 30,000 volumes. By means of subscriptions to scientific periodicals, the gradual accumulation of complete sets as funds are made available, and by the purchase of modern manuals, it is hoped in the course of three or four years to have a working library sufficient to meet the demands which will be made upon it. This plan contemplates provision for biological (including medicine), chemical, pharmacological, pharmaceutical, toxicological, and physical literature, together with the necessary works on botany and zoology not especially provided for in those bureaus having botanists and zoologists under their immediate direction.

The library will not be solely for the private use of the laboratory, but will be open to such of the public as care to avail themselves of its privileges under the library rules which will be adopted. The inestimable advantage to the medical profession of the Philippine Islands, of an adequate library, alone would justify the expenditure, apart from all other considerations, and when in addition the library will furnish all the working material for the bureau of government laboratories and a large proportion of the allied bureaus, its absolute necessity will at once become apparent. A competent librarian will be engaged and modern methods of cataloguing will be adopted as soon as a sufficient number of books are on hand to warrant the expense. At the present time, no library room is available in the temporary building and an addition to the present quarters is necessary at the earliest possible moment.

Apparatus and Supplies.

The estimates for apparatus and supplies were previously submitted to the honorable the secretary of the interior, and the individual items of this list have been carefully compiled in such a way as to avoid all purchases which by a careful review of the field are demonstrated to be actually unnecessary within the first year, but the equipment, if purchased as originally planned, is such that all operations which can be foreseen at present will be carried on. In the present plans, one room has been provided with apparatus for distillation, extraction, filtration, precipitation, and other classes of work on a reasonably large scale, so as to afford sufficient materials for experimentation.

In connection with the apparatus lists, but not included therein, are the necessary lathes, shapers, and tools for an instrument maker. Experience in all laboratories has demonstrated the necessity of a mechanic on the ground, and this is especially true in so remote a region as the Philippine Islands, where even the simplest repairs to finer apparatus, such as microscopes and balances, can not be executed. The services of a glass blower for the purpose of constructing glass-

ware not to be purchased in the market, and for the repair of such delicate pieces as are sure to become broken in the course of a year, will also be necessary, and provision has been made for this branch of mechanical work. One difficulty in conducting laboratory work in Manila is the lack of a municipal gas supply. As a consequence, makeshifts must be resorted to. Gasoline, experience has shown, is unsatisfactory in the Tropics, acetylene produces a small, very hot, and pointed flame, which cracks glassware. Both these means of laboratory heating have been tried within the past year. A type of gas apparatus, manufacturing illuminating gas from cocoanut oil, is constructed in Manchester, England, and one such machine is at present in Manila, and for sale. It is the intention of the bureau of government laboratories to purchase this machine and install it in the temporary building. By this means it will be given a thorough trial before the new structure is completed, and, if found satisfactory, will be adopted for permanent use. The complete apparatus is of sufficient capacity to supply the future needs if a new and larger gas holder is constructed.

The Bureau of Weights and Measures.

As was mentioned in the discussion of the plan of the building, a space has been set apart for a physical laboratory, and as the equipment of this branch of the service will be at present the only one of the kind in the islands, and as the establishment of another laboratory in the future would seem unnecessary and a duplication of expense without any adequate return, it is urgently recommended that the charge of weights and measures of the islands be intrusted to the bureau of government laboratories, when it is prepared to undertake the work, which will be as soon as the building is completed. Weights and measures, as well as electrometric, photometric, and thermometric apparatus, will be secured by the bureau of government laboratories, and it will not only establish standards for the use of the government, but will also undertake, for a moderate cost, the mensuration of apparatus belonging to private individuals and corporations on the same principle as is now being done in Berlin by the Reichsanstalt, and in Washington by the Bureau of Weights and Measures. It is believed that the income derived from this class of work will ultimately fully pay for the expense of the physical laboratory.

The Serum Institute.

The institutes for the preparation of prophylactic serums and of vaccine virus are at present under the control of the board of health. A temporary institute has been constructed at San Lazaro, comprising a small laboratory, sheds for vaccine calves, horses, and cattle, and fenced inclosures for isolating animals which are under treatment. The work of preparing serums has been begun, and, as far as possible, will be pushed in the present quarters. The new laboratory building will, however, supply facilities which it is impossible to secure in a separate location without great expense, and consequently a modern serum plant has been provided for in the new quarters. As the work in this direction is so closely allied with laboratory work in general, it would be expedient to combine the serum and vaccine institutes with the government laboratories, in charge of a director.

There is no branch of the laboratory work in which an expenditure sufficient to obtain an adequate equipment and to purchase and maintain the necessary animals will more surely bring returns in the near future. The prevalence of rinderpest in the islands has rendered the importation of fresh stock so hazardous an undertaking that the future of the agricultural interests is gloomy, unless some remedy can be procured. This remedy can alone be supplied by a well-organized serum institute which will be able to furnish prophylactic serum in sufficient quantity to immunize all imported cattle immediately upon their arrival in the islands. To do this it is estimated that a herd of some 100 to 150 government cattle will ultimately be needed. The number of trained workers in this undertaking will need to be increased from time to time, as new cattle are procured. At present the herd consists of 18 head; the employees are a director and assistant director. The necessity of good vaccine virus has already been demonstrated, and the vaccine institute in charge of the director of the serum institute can, with but slightly increased facilities, supply the entire demand. With an

equipment sufficient to successfully combat rinderpest, the serum institute will also be able to supply antipestic, antidiphtheritic, and other prophylactic serum at but slight additional expense.

Plan of Employees of the Bureau of Government Laboratories.

According to a plan furnished the honorable secretary of the interior on March 18, 1902, the employees of the laboratories when the new laboratory is completed and ready for occupancy should be as follows:

Superintendent of government laboratories	$4,000	Assistant chemist	$1,200
Animal parasitologist	2,500	Photographer	1,200
Plant pathologist	2,500	Assistant engineer	1,200
Physical chemist	2,400	Clerk	1,020
Pathologist	2,400	Anatomical artist	900
Chemist and investigator	2,000	Glass blower	900
Analytical chemist for mineral analysis and mineralogist	2,000	Librarian	900
Analytical chemist	1,800	Storekeeper	900
Physiological chemist	1,800	Preparator of culture media	600
Pathologist	1,800	Curator	600
Entomologist	1,800	Curator	300
Drug assayer and toxocologist	1,800	Janitor	240
Engineer and electrician	1,600	Servant	240
Assistant biologist	1,500	Caretaker	240
Assistant bacteriologist	1,500	Three oilers, each at	150
Property clerk	1,500	Four stokers, each at	150
Assayer	1,500	Two messengers, each at	150
Soil and water analyst	1,500	Two servants for storekeeper, each at	150
Two stenographers, each at	1,400	Two laboratory assistants, each at	150
Mechanic and instrument maker	1,400	Eight servants, each at	90
Chemist and food analyst	1,200	Four laborers, each at	90

The Chemical Laboratory.

The construction and maintenance of adequate chemical laboratories in conjunction with various lines of government scientific work, has, since the famous relationship between the French revolutionary government and the chemists charged by them with the production of explosives, gradually become a recognized necessity with all civilized nations. In many countries such institutions have sprung up gradually, as the exigencies of the case required, in conjunction with undertakings which have been inaugurated from time to time. This method has resulted in the growth of numerous separate laboratories, each in part devoted to some especial line, but all overlapping and duplicating each other to a greater or less extent, because the apparatus and training required in one is to a certain degree identical with that needed in others. Laboratories connected with agricultural work, making examinations of soils and foodstuffs would necessarily encounter many questions which could equally well be settled by those devoted to forestry, geology, or mineralogy. Biologists and pathologists, in modern times, have a constantly increasing call for chemical knowledge, with the result that institutions with which they are connected soon begin to develop chemical laboratories, and so the reduplication goes on as each branch of science begins to feel the need of such an adjunct to its work. Such a condition of affairs can be avoided at the outset by the construction of one central institution, which will combine the facilities necessary to all with such special apparatus and expert talent as are needed by the individual lines of work. This aim has been kept in view in the plan of the laboratory force and new building so that although the expense when concentrated in a single estimate may seem somewhat high, yet it must be borne in mind that with any other plan a much greater outlay would be spread over various bureaus without becoming so apparent.

Government chemical laboratories being a necessity, it is obviously economical to concentrate all of them under one head and to provide adequately for their efficiency and success. In no branch of modern science, except it be physics, is a full equipment of modern apparatus and appliances a greater essential to success-

ful work than it is in chemistry. In former times, when the science was more elementary and when the demands on the variety of resource of the worker and the need of accuracy and above all the speed of work were much less, a smaller equipment would do, but at present many essential features of knowledge are demanded and many operations conducted which were then impossible. Inadequate equipment is to-day the poorest economy in a chemical laboratory because the salary list, being a continued outlay, is the most expensive part of the institution; so that the greater the number of labor-saving devices there are in use, the greater will be the amount of work turned out and the smaller the working force necessary to do it. Analyses which formerly took weeks can now, with proper means, be done in as many days, and important conclusions can now be reached in a short time by means of some modern instrument of precision, which formerly were arrived at by tedious experimentation, if, indeed, the desired result could be accomplished at all. It must further be borne in mind that many lines of work which are of fundamental importance to the financial welfare of the islands can not be undertaken at all without proper means and appliances.

The present laboratory is a makeshift, allowing only of the simpler kind of chemical work, and the lack of apparatus has materially increased the time necessary to reach results; the ingenuity and patience of the working force has been taxed to accomplish at all what under other circumstances would have been done with facility and rapidity. The hope of a new and suitable building in the near future has, however, made it easier to undertake work, and the entire laboratory force has endeavored to do what it could with the materials on hand.

The efficiency of a laboratory depends upon the skill and technical training of the men in it, as well as upon their general intelligence. The Philippine Islands offer no material really fit properly to fill scientific positions in a chemical laboratory, and such candidates as are available, no matter what they imagine themselves to be, do not really have sufficiently wide experience or systematic knowledge to enable them satisfactorily to fill the vacant positions. In routine work absolute accuracy and honesty are prime essentials; even one erroneous result returned, say, to the custom-house, might entail a change of many dollars in duties. The director of the chemical laboratory must be able to rely perfectly upon the reports of his subordinates, and in order to make such reliance possible, the laboratory force must be of a high order. Realizing this fact, the bureau of government laboratories entered into negotiations with the civil-service bureau with a view of establishing a list of eligibles for the various laboratory positions, ranging in salary from $1,500 to $2,000 a year. Examinations have been held in the United States, but the results have shown that, with the exception of one man, who had been previously recommended and had agreed to try the examinations, the applicants do not come from the best-trained scientific circles. Chemists with any prospects at home do not consider the salaries a sufficient inducement, and the candidates have been young graduates just on the threshold of their careers, or in some cases even men who have not completed a thorough chemical course anywhere. It is possible that in time, as the knowledge of the improved facilities for work in the Philippines becomes more general in American scientific circles, better equipped men will apply for positions; but it is also possible that larger inducements must be offered.

The routine work of the laboratory for the past year is given by the following table:

Report of routine work in chemical laboratory.

Subjects.	Miscellaneous.[a]	Custom-house.	Mining bureau.	Bureau of forestry.	Bureau of architecture.	Civil hospital.	Board of health.	Court of first instance.	Police department.	Insular purchasing agent.	Bureau of agriculture.	Bilibid prison.	Total.
Paints	------	89	------	------	------	------	------	------	------	------	------	------	89
Liquors	4	24	------	------	------	------	3	------	------	------	------	------	31
Oils	------	25	------	------	------	------	------	------	------	------	------	------	25
Glycerin	------	1	------	------	------	------	------	------	------	------	------	------	1
Foods	------	5	------	------	------	------	1	------	------	------	------	------	6
Textile fabrics	------	11	------	------	------	------	------	------	------	------	------	------	11
Miscellaneous	------	15	------	------	------	------	------	------	------	------	------	------	15
Custom-house decisions	------	8	------	------	------	------	------	------	------	------	------	------	8
Minerals	3	------	------	------	------	------	------	------	------	------	------	------	3
Coals	5	------	10	------	------	------	------	------	------	------	------	------	15
Iron ores	------	------	5	------	------	------	------	------	------	------	------	------	5
Limestones	------	------	3	------	------	------	------	------	------	------	------	------	3
Soils	3	------	------	3	1	------	------	------	------	------	1	------	8
Wood extract	------	------	------	1	------	------	------	------	------	------	------	------	1
Stone	------	------	------	------	1	------	------	------	------	------	------	------	1
Urines	133	------	------	------	------	183	------	------	2	------	------	1	319
Carabao and cow milk	8	------	------	------	------	1	2	------	------	------	------	------	11
Suspected poisoning	------	------	------	------	------	1	------	1	1	------	------	------	3
Waters	5	------	------	------	------	------	1	------	------	------	------	------	6
Coffee	------	------	------	------	------	------	------	------	------	1	------	------	1
Human milk	2	------	------	------	------	------	------	------	------	------	------	------	2
Salt	1	------	------	------	------	------	------	------	------	------	------	------	1
Gastric juice	2	------	------	------	------	------	------	------	------	------	------	------	2
Contents of stomach	1	------	------	------	------	------	------	------	------	------	------	------	1
Fæces	1	------	------	------	------	------	------	------	------	------	------	------	1
Disinfectants	5	------	------	------	------	------	------	------	------	------	------	------	5
Total	173	178	18	4	2	185	7	1	3	1	1	1	574

[a] Including analyses for the bureau of government laboratories, police, municipal physicians, etc.

The chemical laboratory undertook the manufacture of benzoylacetyl peroxide (benzozone or acetozone) and its experimental introduction in the Philippines as an intestinal antiseptic. In all about 3 kilos of the crystalline product had been used up to June 30, 1,350 liters of 1–1,000 solution were prepared and distributed, and about 3,000 capsules given out. The work of making the peroxide still continues, and experiments with it in new fields are being undertaken. A detailed report as to the preparation and use of this antiseptic in the various cholera hospitals and in dysentery is appended; the results in other lines are not as yet sufficiently complete to warrant publication.

The most extended work in routine analyses undertaken by the chemical laboratory up to the present time has been for the custom-house and mining bureau.

Analyses of Iron Ores and Limestones.

The mining bureau transmitted an interesting series of iron ores from the old Hison and the Constancia mines at Angat, Bulacan. Three of these were ores which are at present being worked and smelted, and one of them, a specular iron ore, shows a very high value. This was used in the Hison mine, at Angat, Bulacan, and one of the others, from the Constancia mine, is very nearly equal to it in value. In a sample of hematite over 1 per cent of cobalt was encountered. The complete analyses given in the report of the mining bureau demonstrate the necessity of a careful mineralogical review of these regions, the presence of cobalt rendering likely the subsequent appearance of nickel. An analysis of a sample of slag, which was taken from one of the smelters using ores from these mines, shows

that the native processes are crude and wasteful. The relationship between the government laboratories and the mining bureau is such as to render systematic work in mineralogical investigations possible in the future and the plans of the new laboratories provide for a location in which not only mineral analyses can be conducted, but in which crystallographical and petrographical work can be carried on.

Once inaugurated, the importance of this work is such as to warrant a considerable outlay of time and energy. The beginning of the systematic mineralogical review of the region in Bulacan is found not only in the five analyses of iron ores reported upon, but also in the examination of several samples of limestone from the Bayabas River, Bulacan, coming from a formation composed of a series of beds well exposed, near the Santa Margarita spring. One of these limestones is of considerable value, from a metallurgist's or cement maker's standpoint, if it is present in sufficient quantities. It contains only 1 per cent of magnesia, 6 per cent of aluminum, with small amounts of other impurities. The other two limestones, while somewhat higher in calcium carbonate, are also considerable higher in magnesia and might, for this reason, not be as well adapted for some purposes, although just as valuable for others. The complete analyses of such complex minerals as the iron ores and limestones have proven themselves to be, involves a large expenditure of time with the present facilities and laboratory force, and owing to stress of other work the analyst assigned to these samples was not able to put his time uninterruptedly upon them. This condition will be altered in the future, when the laboratory will be able to take care of all of this work coming to it through systematic efforts in collecting material.

Several samples of waters taken from the hot springs at Itogon and Tuel were examined in the course of the year, because it is the opinion of the natives of Benguet that these waters have a high medicinal value. The analyses show that such is not the case, the mineral contents being no more than might ordinarily be found in any average spring water, and any therapeutic value which may be assigned to them is due only to the temperature.

The other routine analyses do not need a special mention. A glance at the table will show that they cover a large field and that eleven bureaus have availed themselves of the opportunities afforded.

The following extracts from a letter from Mr. R. Vorfeld, acting chief of the appraiser's division, will serve to show the importance of the bureau of government laboratories to the custom-house:

* * * Even prior to the enactment of the tariff law now in effect in the Philippine Islands, and as soon as the officers charged with the appraisement of merchandise acquired a more thorough technical knowledge of the same, the importance of a chemical laboratory as an adjunct to the customs service became apparent. About two years ago the advisability of establishing a separate customs laboratory was considered, but this plan was abandoned as soon as it was realized that the necessities of the service would not justify the equipment and maintenance of a separate laboratory. When, on the 15th of November, 1901, the customs tariff for the Philippine Archipelago was declared in effect, the bureau of government laboratories had been established and was prepared to render the customs service the required assistance. The tariff at present in force, enacted along more modern lines than the old or Spanish tariff, of which the United States provisional customs tariff and regulations were a translation, gave rise to many contingencies which made laboratory assistance imperative. In several instances the rate of duty provided for certain articles of merchandise is made subservient to the results of a chemical analysis, and an appraisal of the substance can not be made without recourse to such an operation. The application of rule 15 of the tariff provides much material for chemical analysis, as in many cases mixed component materials are so nicely balanced that the "component material of chief value" must be determined by chemical examination. The greater number of customs analyses are made for the protection of the revenues when protests against classifications are entered. Others, however, are made pursuant to the request of importers before examination. * * *

(*a*) Samples forwarded and reported upon prior to January 1, 1902:

Liquors (for statistical purposes)	19
Fats (butters)	4
Textile fabrics	3
Miscellaneous	2
Total	28

(*b*) Samples forwarded and reported upon since January 1, 1902 (recorded in the "Record of analytical examinations"):[a]

Paints	77
Liquors	5
Mineral oils and schist products	23
Other oils and fats	2
Textile fabrics	2
Metal compositions	12
Miscellaneous	1
Total	122

In addition to the above-reported number of analyses, the superintendent has, on request, rendered the following opinions on the mentioned subjects:

(*c*) Opinions rendered by the superintendent:

On definition of metallic paints	1
On faïence, clay, and similar wares	1
On ordinary and fine toilet soaps	1
On schist products and mineral oils	1
On liquified anhydrous ammonia	2
On malted milk and similar invalid foods	1
On crucible steel	1
Total	8

* * * The samples which have been forwarded for analysis are mostly types—that is, a paint of a certain brand is analyzed once upon first importation, the result registered, and the established classification serves for all subsequent importations of that brand. Only control samples are taken and subjected to analysis from time to time to guard against possible misrepresentation. * * * Between December 1, 1901, and June 30, 1902, 52,248 kilos of zinc colors were imported, both dry and prepared. Dry zinc oxide is, however, only imported by the local drug firms, and its importation is estimated not to exceed 6,000 kilos yearly. This would leave 48,248 kilos of prepared zinc paints. Of the 77 samples of paints reported as having been forwarded for analysis, 35 were zinc colors, of which 19, or 54.3 per cent, contained the materials (barytes, chalk, or terra alba) that caused a surtax of 50 per cent over the regular rate of $5 per 100 kilos to be applied.

During the same period 578,360 kilos of other metallic colors were imported. Estimating that 60 per cent of that amount were prepared, 361,016 kilos of prepared colors were analyzed, and 29, or 78.4 per cent, contained the substances for which a surtax is provided. Instead of $3 and $5 per 100 kilos, these paints paid $5 per 100 kilos, plus a surtax of 50 per cent.

GUTTA-PERCHA, GUTTA, AND RUBBER.

The laboratories undertook the investigation of various samples of Philippine gutta-perchas and rubbers. The work was in charge of Dr. P. L. Sherman, who submits the following report:

On the completion of my investigations of rubber and gutta-percha in Java and the Straits Settlements, and later on in southern Mindanao and the Sulu Archipelago, I was ordered transferred on May 15 from the forestry bureau, under the instructions of which the investigations were made, to the bureau of government laboratories, in order that further examinations, both physical and chemical, might be made of specimens of gutta-percha and rubber previously collected.

PHYSICAL AND CHEMICAL ANALYSES OF THE GUTTA-PERCHA AND RUBBER OF THE PHILIPPINE ISLANDS.

GEOGRAPHICAL DISTRIBUTION.

From the southern part of Paragua on the west and the southern part of Mindanao on the south and east, and as far as Benguet to the north, gutta-percha and

[a] To July 1, 1902.

rubber producing trees and vines have been reported present and growing luxuriantly. According to Spanish botanists, the following were found and named:

Name.	Locality.	Product.
Ficus elastica, Nois	Manila and many localities south	Rubber.
Palaquium latifolium, Blanco	Vicinity of Davao and as far north as Tarlac Province.	Gutta-percha.
Palaquium luzonensis, Vid	Mindanao	Do.
Balete	Throughout the archipelago	Gum.
Artocarpus elastica, Mig	Mindanao	Rubber.
Artocarpus incisa, Lin		
Ficus concenner, Mig	Throughout the archipelago	Do.
Ficus superbus, Mig	Western Mindanao	Do.
Alstonia scholaris, R. Br	Mindanao	Gum.
Ficus radiata, Deve	do	Rubber.
Ficus radicans, Roxb	do	Do.
Ficus britrianensis, Garc	do	Do.

Besides these, trees producing gutta-percha or a closely allied product have been reported from Tayabas Province and the islands of Sibuyan, Negros, and Cebu. In Sibuyan, as well as in Benguet, a large vine giving a peculiar gum or rubber has also been reported, but so far it is not known if the vines encountered in these localities are the same as those given in the above list, nor have they been identified botanically.

While it is not expected that the plants tabulated above produce products of high commercial value only, yet it can safely be assumed that all of the species of trees and vines throughout the islands which give gutta-percha, rubber, and allied products are not included. This is shown by the fact that of five different species of gutta-percha producing trees and one rubber vine which I collected on my trip of investigation last year in the Sulu Archipelago and Mindanao, most or all appear to be unknown botanically. These considerations pointed to the conclusion that the islands are unusually rich in this class of trees and vines, and therefore nothing definite could be stated regarding the resources of the Philippines in this respect until reliable specimens of the products had been collected from the different species and tested physically and chemically. This work was undertaken by the bureau of government laboratories.

The principal object being to determine the commercial and economic value of the gutta-percha and rubber now gathered and exported from the Philippines, I began by investigating the specimens taken either from sample lots ready for exportation from the southern ports, or else gathered by myself from the trees and vines recognized by the natives as producing the gutta-percha and rubber of commerce. By this means I hope to show: First. Of what the gutta-percha and rubber as exported from the Southern Philippines consists. Second. If the commercial articles are as good as can be obtained; in other words, if unadulterated, or if some species of trees or vines do not contain better gutta-percha and rubber than are handled commercially.

Samples of Gutta-percha and Rubber Secured for Analysis.

Judging from our proximity to Borneo and the Dutch East Indies, we might suppose that the methods for gathering gutta-percha and rubber practiced by the wild mountain tribes there would cross over to the Philippines simultaneously with a demand for those products. So far as reading and personal observations go, we may assert that we not only have the Borneo methods, but indeed these so modified as to be worse even than the original. In general, those adopted by the Moros of Mindanao and the Sulu Archipelago are all based on the plan of cutting down the trees or vines in the first place, and then, by incisions in the bark made in a variety of ways, of securing as much milk as possible without too much work or too many precautions being taken to save a large proportion from being lost. After the milk is gathered it is coagulated by mixing with sea water or boiling and the resulting product worked into balls and rolls along with dirt and bark and sold to Chinese buyers in the seaport towns of the southern islands for exportation to Singapore. After visiting most of the towns of the southern islands from which these products are exported, I found them to come from the following regions:

1. The Sulu Archipelago.
2. Subano.
3. Biñang.
4. Talayan.
5. Davao.

The last four regions are in Mindanao and practically embrace all the mountain chains and forests along the southern coast from Zamboanga to Davao.

For analysis I took samples from all of the regions above mentioned, except the last (no good samples being obtainable at the time of my trip), and in addition secured the product from five different gutta-percha-producing trees and one rubber-producing vine, care being taken to keep the samples as free as possible from dirt and admixture with the milk of any other tree. These six different species, while probably not the only ones producing the gutta-percha and rubber now being collected in the Philippines, are, nevertheless, according to the native collectors, the principal ones, and the following analyses bear out their assertion:

CHEMICAL AND PHYSICAL EXAMINATION OF GUTTA-PERCHA AND RUBBER.

I. GUTTA-PERCHA.

To fulfill its object from a commercial and economic, rather than a purely scientific standpoint, a physical and chemical examination of gutta-percha should answer the following questions:

1. What are the component parts of this compound?
2. In what proportion are these parts present?
3. Are they the same as are found in the best grades of gutta-percha or are they of inferior grade?

Knowing these facts it is easy to put the gutta-percha examined in its proper place. The sample of gutta-percha selected as a standard (see sample No. 1) was taken from a gutta-percha tree (*Dichopsis gutta*), and is recognized by all experts and cable companies as the best grade of gutta-percha obtainable. This with the samples of Philippine gutta-percha were submitted to identical methods of chemical analyses, with the following results:

Table of analyses of various Singapore and Philippine gutta-perchas, showing composition and comparison.

Source of specimen.	Appearance.	Dirt.	Gutta.	Resins.	Water.	Ratio resins to gutta.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	
1. Collected by Dutch officials in charge of the government gutta-percha plantation, Java, from trees of species Dichopsis gutta, and considered a fair sample of best gutta-percha.	Close, compact, tough; whitish to pink and brown.	1.99	74.77	20.74	2.49	1:3.6
2. Product from two trees of the same species growing close together, island of Tawi-Tawi, southern central coast. Considered by Moros as superior grade.	White, somewhat elastic; very tough.	2.05	48.19	41.38	6.59	1:1.15
3. Purchased from Moros at Bongao. Gathered in Tawi-Tawi. Considered second grade.	Tough, compact slab; brownish red.	15.83	28.60	37.42	18.32	1:0.7
4. Product from large tree in mountains southeast of Cotabato, Mindanao. Considered first grade.	Somewhat tough; white, pinkish, and brown.	2.72	38.42	49.08	9.76	1:0.78
5. Product from tree in mountains southeast of Cotabato. Considered second grade.	Inclined to crumble; color, white to brownish.	16.79	31.30	51.86	.04	1:0.6
6. Product from tree in mountains southeast of Cotabato. Considered third grade.	Dark brown; hard and crumbling.	8.48	23.64	53.99	13.87	1:0.43
7. Brought into Cotabato by Moros from Binang region, and declared by Chinese a second grade.	Long coils on piece of bamboo; dirty and dark colored.	4.60	30.20	57.40	7.80	1:0.52
8. Product from large tree growing along Spanish trocha, north of Tukuran, Mindanao. Considered third grade.	Heavy, compact mass, crumbling easily; light reddish brown.	17.04	24.55	43.21	15.19	1:0.56
9. Brought into Cotabato by the Moros from the Subano region northwest of Tukuran, Mindanao. Considered by Chinese merchants to be the finest grade.	Clean, pinkish balls, size of croquet balls; rather tough.	5.76	32.49	54.08	7.61	1:0.6

EXPLANATION OF TABLE.

From the foregoing description of the manner adopted by the Moros for gathering gutta-percha, it may be surmised that no great precautions are taken to keep it clean. In fact, a plentiful amount of chipped bark, water, coloring matter, and other impurities are allowed to fall into the milk, and through coagulation become intimately mixed with it. The chemical examination of gutta-perchas reveals them to be composed of many bodies, which may be grouped under the heads of "dirt," "resins," "water," and "gutta."

The analyses were made after the method recommended by Obach,[a] in which the gutta and resins were separated from the dirt by means of chloroform, and these in turn separated from each other by hot alcohol, leaving the water to be determined by difference.

It is customary to consider under the head of "dirt" all foreign substances found, excepting resins and water. In most samples of commercial products this dirt is chiefly in the form of chopped-up bark, which adheres to the gutta-percha or rubber as it is taken from the trees and is never removed in the after treatment. Sometimes more bark is mixed in, or, better still, stones, pieces of bamboo filled with water, anything, in fact, which will increase the weight of the balls is dexterously added—on the inside. In the analyses no account is taken of these willful adulterations, but portions are selected which show an average amount of "dirt" gathered during the preparation of the sample by the natives. From 2 to 6 per cent of dirt is not only admissible, but generally unavoidable, and even when gutta-percha is cleaned for use on submarine cables by the usual methods from 1 to 2 per cent of this objectionable material always remains.

Under "resins" are considered resin-like bodies which properly belong in the gutta-percha; in other words, they, mixed with a substance known as "gutta," form the compound called "gutta-percha." These resins may vary greatly in appearance, from white crystals to sticky, yellowish oils, according to the species of tree from which they are derived. They are readily soluble in hot alcohol, and in this way are easily separated from the "gutta."

The best gutta known contains from 10 to 15 per cent of resinous bodies, and these are then generally considered to be not detrimental, as they are insoluble in water, become soft when heated, are good insulators, and while increasing the volume of the gutta-percha do not materially lessen its toughness. In fact the insulating material used for submarine cables at the present time is usually prepared with one part of resins to every two parts of gutta. Beyond that point the brittleness and other objectionable features become apparent and the gutta-percha is unfit for the best cables, and has to be mixed with a high grade in order to bring the percentage of gutta up to the required amount. Obach described a process used by the Siemen's Cable Company, of London, by which they extract a certain amount of resins from a low-grade gutta-percha, thus making it a high grade. The method is probably used in some form or other, but the details are kept secret.

The ratio of gutta to resins gives a fair idea of the value of a sample of gutta-percha, although other factors enter into consideration to a large extent. The above table shows that in Nos. 3, 4, 5, and 9 the ratio is practically identical, although some are commercially given a higher value than others. In reality the ratio of gutta to resin and the quality of the product contained should alone determine the value.

The resins which I isolated from the various samples were not analyzed, but put aside for future examination.

The percentage of "water" in commercial gutta-percha varies greatly. When the gutta-percha milk flows from the tree it contains a large proportion which, during coagulation of the gutta and resins, mechanically become inclosed by them in varying quantity and remains indefinitely unless dried out by heat. The Chinese in the Philippines, as well as many of the Moros, have learned from Singapore Chinese that by softening the gutta-percha in hot water and kneading it dough-fashion for some time at least 10 per cent of water can be added to its weight. As almost all of the water must be dried out of the gutta-percha before it can be used for cable insulation, this ingredient can only be considered as detrimental.

By "gutta" is meant the active principle, so to speak, of gutta-percha. It is that part by virtue of whose peculiar physical and chemical properties, gutta-percha softens readily under the influence of gentle heat, becomes plastic and easily molded, protects the copper wires of submarine cables for scores of years against the corrosive action of sea water, and insures almost complete insulation for the electric current. Obach and others who have written on the subject describe

[a] Gutta-percha and Rubber, by Dr. Eugene Obach.

several kinds of "gutta," of many colors, and varying degrees of toughness, elasticity, electrical resistance, etc. The chemists of the submarine cable companies, who probably know the most on the subject, have written nothing, so it is still a question to decide if there are one or more so-called guttas. As a standard for comparison, at any rate, we are safe in taking the gutta obtained from the tree species, *Dichopsis gutta* (sample No. 1), because it has furnished the gutta necessary for most of the submarine cables already laid and has stood the test of years of service. The all-important question concerning Philippine gutta-percha is, then, What kind of gutta does it contain, the gutta serviceable for cable insulation, or an inferior kind? The only expert opinion on this matter which has come to my notice was that given by Mr. H. A. Reed, of the Bishop Gutta-Percha Company, New York, on samples of Philippine gutta-percha submitted to him through the United States Secretary of Agriculture, by the Philippine forestry bureau.

He says, in reference to the gutta found in them, that the inferiority of the gutta-percha of this type is due not only to a large proportion of resins, but, even after being separated from the latter, it lacks the tensile and chemical properties of the genuine article. Thinking that my samples might be different from those submitted to him, or that perhaps his method of isolation of the gutta was such as to injure or change its original properties, I separated the pure gutta in considerable quantities from four representative samples by means of solvents and then dried them in a stream of carbon dioxide, to prevent change. When heated to the temperature of boiling water they all became quite plastic and easily admitted molding or cutting into any desired shape necessary for the following experiments:

Gutta.	Color.	Action toward—			
		Light: Refractive index 70° C.	Rotation in 0.5 per cent solution.	Heat: Softening temperature.	Stress: Tensile strength per square inch.
				°C.	*Pounds.*
No. 1	Light brown	1.5093	+6.75	62	5,262.4
No. 2	Cream white	1.5088	+6.5	60	6,668.15
No. 4	Yellowish white	1.5089	+7.5	61	5,134.7
No. 8	Cream white	1.5076	+4.75	56	Brittle.
No. 9	Very light chocolate	1.5093	+6.5	61	6,451.45

EXPLANATION OF TABLE.

The "color" of the guttas undoubtedly comes from the bark of the tree when cut to secure the gutta-percha, for, by repeated solution and precipitation, the color may be almost entirely eliminated, leaving the gutta only slightly tinted from a cream color to light pink and pure white when finely divided. The Singapore buyers, however, use a color test as a means of identifying the different classes of gutta-percha brought into the market, the pink and light-brown grades being considered superior to the white. The Chinese have also found that if a white gutta-percha is kneaded in hot water with some of the chopped-up red bark, it acquires a pinkish to brown appearance, which helps its sale materially, although of course adding nothing to the real value. It is my opinion that all variations of color are only incidental and not connected with the chemical structure of the gutta itself. The amount of color in the above samples was minimum and not sufficient to have any material effect on the physical properties. The other experiments with light, namely, those given under refractive index and rotation, are employed with great success in the commercial analysis of sugars, oils, fats, butters, etc. This is due to the fact that each chemical individual, provided it is capable of transmitting light, has an index of refraction peculiar to itself, which, for purposes of comparison, must be taken under constant conditions and, provided it is able to rotate the plane of polarized light, a degree of rotation which is also constant. While two chemical individuals may show identity in some one physical property, they can not continue this identity in two or more, so that more than one method was necessary to determine the relationship of the guttas examined by me. Substitution, adulteration, or variation in chemical structure can in this way be easily discovered and determined. Owing to certain mechanical and chemical difficulties encountered in making these determinations on the guttas, the limits of error of experimentation are outside of the differences found between Nos. 1, 2, 4, and 9, but do not include the marked differences displayed by No. 8. In determining the refractive index an Abbe-Zeiss refractometer was employed, a small amount of a concentrated solution of pure gutta in chloroform placed

on each of the prisms and allowed to stand until the odor of chloroform had entirely disappeared. The prisms were then closed and kept at a temperature of 70° C. until the readings became constant, showing that all chloroform had evaporated. The above figures are the results of many determinations made with carefully prepared samples. The rotation was determined in chloroform, 0.5 per cent solutions being used because, when more concentrated, the absorption of light was too great to admit of accurate readings.

The physical tests given in the above table are so diversified as to bring out clearly the extent of resemblance or difference between the various samples of gutta submitted to them. The results show little variation between Nos. 1, 2, 4, and 9; indeed, these samples may be regarded as practically identical in composition. The physical constants appear to be those of a single chemical individual, the refractive index varies only in the third decimal place, the rotation is the same within the limits of only one degree, and the softening points carry only from 60° to 62°. The slight amount of color in those of the specimens, which it was impossible to remove, would be sufficient to account for even greater variations. No. 1, however, is the best sample used for a standard, and taken from Dichopsis gutta; Nos. 2, 4, and 9 are from the Philippine Islands. It would appear from this that gutta is a chemical individual, identical in all cases, and any substance, such as No. 8 for example, which varies from the properties recorded above, should not be designated as such. This opinion is, however, advanced subject to further confirmation by extended chemical investigation looking toward the determination of the chemical constitution of gutta. In the case of sample No. 8, the substance designated as gutta and the real gutta of No. 2 are very similar in appearance and chemical behavior. In tensile strength, however, they are widely divergent, and this difference is accentuated and not lessened by the other physical tests; for while these latter differences are not so marked, yet they clearly show that all the physical constants of No. 9 differ more or less from all the others, and hence this substance must certainly be different in chemical constitution. The wild Moros who chopped the tree down for me were certainly right in saying it was the most inferior of all.

By way of expert testimony, the samples of the various guttas were shown to Messrs. Hamilton and Winter, chief electrician and cable engineer, respectively, of the U. S. cable ship *Burnside*, who have had many years experience in testing and laying cables. They pronounced the guttas to be evidently of superior quality and worthy of thorough testing and exploitation, especially in view of the fact that thousands of miles of submarine cables must be laid between these islands, the best and only durable insulation for which is gutta-percha.

The action of heat in softening gutta-percha and making it plastic has previously been used as a test of value. It has been found that the best grades require more heat to soften them than the lower grades. According to the results obtained by me, the inferior grade of gutta (No. 8) also possesses the property of softening at a lower temperature than the superior gutta. The softening point was determined by molding a piece of gutta into the bottom of a glass tube sealed below, placing a sharp-pointed glass rod in contact with the surface and gradually heating in a bath of sulphuric acid until the point of the glass rod just began to enter the gutta.

The tensile strength, or toughness, possessed by gutta, next to its resistance to sea water, is undoubtedly its greatest merit commercially. Even the inferior grades of gutta-percha are used for objects requiring toughness combined with pliability and strength. In the insulation of a submarine cable great toughness is imperative, for during the laying of the cable it is constantly subjected to great strains from kinking, pulling, rubbing, etc., and when it has reached the ocean bottom, where the pressure is often 3½ tons to the square inch, it must not have sustained a fracture even as large as the diameter of a fine hair, for otherwise the moisture would slowly penetrate to the wires, the insulation would not be complete, and the cable would have to be pulled up and repaired.

In order that the measurements made might be within the limits of the instruments at hand, only small strands of gutta could be used for testing. To make these strands free from minute air bubbles was well nigh impossible, in consequence of which the breaking was in most cases brought about by weakness due to this source. The figures, while thus only approximate, are below and not above the true values and show clearly the enormous tensile strength of my samples. Obach gives a tensile strength of 5,000 pounds for the best gutta-percha, while for gutta he found about 6,500, which closely corresponds to results given above. This also brings out most clearly the excellent quality of the best Philippine guttas.

To make the necessary electrical tests which were to have been included in the above table, especially sensitive instruments are necessary, owing to the enormous insulating powers of gutta. The instruments belonging to the observatory, U. S. cable ship *Burnside*, and United States Signal Corps were most generously offered

by those in charge, but upon inspection it was found that none were adapted to this special kind of work. An effort was also made to get the work done in Singapore, but without success. Samples will be sent to the United States at once, in order to have the necessary tests made.

II. RUBBER.

The only specimen analyzed was that secured from the natives of Tawi-Tawi, and is representative of the rubber exported from the southern islands. Chemically it is found to be composed as follows:

	Per cent.		Per cent.
Dirt	3.76	Resins	3.16
Rubber	81.57	Water (by difference)	11.51

No account was taken of the large pieces of bark in the center of the rolls, nor of the sea water mechanically inclosed during the coagulation of the rubber. This kind of rubber, secured from large vines, closely resembles the best grade of Borneo rubber, which also comes from the same source. In Singapore it ranks just under the best India rubber, which is acknowledged to be the best second-class rubber in the market. Whether these distinctions of class are due to intrinsic value of the rubber, or to the manner of coagulating and curing it, remains to be proven. This laboratory will take up the subject for investigation.

CONCLUSIONS.

The results of the chemical and physical tests of the gutta-percha and rubber show:

1. That the southern Philippines contain several varieties of trees producing gutta-percha of various grades of excellence.
2. That the Moro collectors have imitated their Borneo teachers in mixing gutta-percha from various species of trees into one mass, which is often further adulterated with bark, stones, and water before being sold to the Chinese for exportation.
3. That the best sample of gutta-percha so far found contains practically equal parts of gutta and resins, while that used for cable insulation calls for two parts of gutta to one part of resins.
4. That the "gutta" contained in the several species of trees is at least equal to that found in the best Singapore gutta-percha.
5. That the rubber is of high grade of its class and it is yet to be shown whether with proper coagulation and drying it will not equal the best commercial (Para) rubber.

THE PREPARATION OF BENZOYL-ACETYL PEROXIDE, AND ITS USE AS AN INTESTINAL ANTISEPTIC IN CHOLERA AND DYSENTERY.

In a paper recently published in the American Chemical Journal,[a] by Paul C. Freer and Frederick G. Novy, it was shown that the formation of organic peroxides by means of the oxygen of the air depended largely upon the surface upon which the organic materials were exposed, and in the course of the article referred to a means was discovered of preparing benzoyl-acetyl peroxide in any desired quantity and chemically pure.

Bacteriological investigation with the solutions of this peroxide in water have shown it to be intensely active as a germicide. One part of the hydrolized substance to 177 of water, and containing only 0.05 per cent of active oxygen, destroys all germs, including spores, almost instantly, and even at a dilution of 1:3,000 vegetating germs, as a rule, are killed within one minute, but the spores require an appreciable time. On comparing these results with similar ones with hydrogen peroxide, 1 :1,000, and phenol 5 per cent, it was shown that hydrogen peroxide, although it contained ten times as much active oxygen as the solution of benzoyl-acetyl peroxide, was by no means as effective, and the same may be said of phenol.

Experiments conducted in this laboratory demonstrated that solutions of benzoyl-acetyl peroxide as dilute as 1 part in 10,000 absolutely destroy the comma bacillus when it is placed in them in fairly large quantities on the loop of a platinum wire, and growth was inhibited, or at least extremely slow, when the dilution was 1 :30,000. Where a culture of beef bullion was directly mixed with equal parts of benzoyl-acetyl peroxide solution, 1 :1,000, the growth was prevented, but at greater

[a] American Chemical Journal, vol. 27, 163.

dilution, where large masses of beef bullion were present, the results were not so satisfactory.

Freer and Novy, at Ann Arbor, have demonstrated that large doses of benzoyl-acetyl peroxide, given in capsule form and amounting to as much as 1 gram a day for dogs weighing from 8 to 10 kilograms, were absolutely harmless, the dogs living in perfect health for from six to eight weeks, when the doses were discontinued. Mr. Charles L. Bliss demonstrated that all of the peroxide was excreted in the form of hyppuric acid. Post-mortem examination of the dogs showed only a slight fatty degeneration of the liver, which might be due to the benzoyl-acetyl peroxide, but which could also very properly be owing to the abnormal conditions under which the dogs were living. Certainly the doses were far in excess of those which would be given to human beings. It has, therefore, been demonstrated that benzoyl-acetyl peroxide can be successfully given internally without damage, and therefore, theoretically, it should be of the greatest value as an intestinal antiseptic.

CHEMICAL STRUCTURE OF BENZOYL-ACETYL PEROXIDE.

Chemically considered, benzoyl-acetyl peroxide may be regarded as hydrogen peroxide, in which one-half of the hydrogen has been substituted by the benzoyl group, and the other half by acetyl. It can, therefore, be considered as the benzoylester of aceto-peracid, or as the acetylester of benzo-peracid, and as such it is subject to hydrolysis, or saponification. Experiments carried on by Freer and Novy demonstrated that benzoyl-acetyl peroxide is in itself inert, and that its activity as an oxidizing substance and as a germicide only appears after it has been subjected to hydrolysis by means of water. When the substance is hydrolyzed, the reaction consists in the formation of aceto-peracid, which remains in solution, and dibenzoyl peroxide which is precipitated as a crystalline, insoluble powder, and which can be filtered from the clear solution. The germicidal effect of the solution, therefore, depends upon the presence of acetoperacid together with small quantities of benzoperacid.

In giving capsules of solid benzoyl-acetyl peroxide, this same hydrolysis will take place in the intestines and the resulting germicidal acetoperacid will have its local effect. Dibenzoyl peroxide has been proven to be practically inert, probably owing to the great difficulty with which it is hydrolyzed.

PREPARATION OF BENZOYL-ACETYL PEROXIDE.

An attempt having been made to obtain a shipment of benzoyl-acetyl peroxide in good condition from America and having resulted in a failure, it was clear that if any quantity of the peroxide was to be used in the Philippine Islands it would have to be made on the spot, and as a consequence a shipment of 10 kilos each of benzaldehyde and acetic anhydride was obtained from Germany.

Some fear was entertained as to the possibility of obtaining any yield of peroxide in a tropical climate, because of the continued high temperature, and consequently experiments in the preparation were at first conducted on a small scale. It soon became apparent that oxidation took place more rapidly at room temperatures common in Manila than it did in the United States, so that whereas complete reaction was accomplished in America in three or four days, the same result could be obtained here in forty-eight hours. The yield is, however, somewhat impaired, as a larger proportion of dibenzoyl peroxide appears to be produced in this climate than is the case in America, but nevertheless the results were sufficiently satisfactory to warrant the construction of a larger apparatus in which 3 kilos at a time could be worked up by means of a forced current of air.

After complete oxidation the crude product is placed in large tubulated containers, covered with petroleum ether and allowed to stand over night, by which means the larger portion goes into solution. The extracted peroxide and solvent are then tapped off at the bottom, fresh liquid added, and the operation repeated a second time. The united solutions are then carefully concentrated on a water bath (the temperature of which must not be above 80° C.) until about one-third has been distilled off, after which the containers are placed in the cold room of the ice plant. Crystals of benzoyl-acetyl peroxide contaminated with some dibenzoyl peroxide gradually separate and are eventually filtered and dried. During the first few weeks these were used without further recrystallization. Subsequently it was shown that the impurity of dibenzoyl peroxide was present in quantities sufficient to materially reduce the doses of benzoyl-acetyl peroxide, and consequently recrystallization from petroleum ether was resorted to in all the preparations used in the later work.

In all 2,750 grams of benzoyl-acetyl peroxide were obtained. The hospitals were at first supplied with double gelatine capsules containing 0.3 grams of benzoyl-acetyl peroxide each, but later it was found expedient to substitute a somewhat smaller dose of 0.25 grams, to be given more frequently, the best results being finally obtained by the use of the latter after coating with two layers of celloidin. At the same time solutions of 1:1000 benzoyl-acetyl peroxide were prepared and supplied in quantity as needed, the total amount used being 1,350 liters. These solutions can be kept without deterioration for several weeks. This work was in the charge of Dr. P. L. Sherman, who kept an adequate supply on hand at all times.

TREATMENT OF CHOLERA BY BENZOYL-ACETYL PEROXIDE AND RESULTS TO SEPTEMBER 1.

The patient, on arrival at the hospital, was immediately put to bed and hot-water bags were placed over the abdomen and at the extremities. In the beginning, benzoyl-acetyl peroxide was used only in solution of 1:1000, which was given by mouth as frequently as possible, and by high rectal injections every six hours, while stimulation, by means of 0.006 of strychnia and 15 c. c. of brandy hypodermically, was resorted to as often as demanded by the condition of the patient. If he was seen early in the disease and had considerable pain, while his general condition was good, 0.008 of morphine was given hypodermically, and if this did not relieve him the dose was repeated in twenty or thirty minutes. Turpentine stupes and hot-water bags were also used to relieve the pain. Vomiting was generally stopped by small doses of cocaine and by pieces of cracked ice.

The preliminary experiments, conducted in a small emergency hospital in the Farola district, proved sufficiently encouraging to cause a more extended use in the hospital which was soon established at San Lazaro, and in this place the administration of double capsules, containing each 0.25 grams of crystalline benzoyl-acetyl peroxide, was first resorted to. The treatment then divided itself into two methods:

First. The administration of benzoyl-acetyl peroxide in solution and in capsules as an intestinal antiseptic for the destruction of the bacilli, and

Second. The administration of stimulants to enable the patient to survive, if possible, the effect of the toxine already present.

It was found that the patients soon tired of the solution when given by mouth, and, if its administration was persisted in, it finally produced protracted vomiting in some cases. The administration of the solution per gram was therefore discontinued and it was eventually used by rectal injection only. The double capsules were always given on an empty stomach, one every four hours, as when given on a full one they were likely to produce vomiting. High rectal injections of 1:1000 solution were given every four hours during the acute stage of the disease, unless the patient was very weak. If the latter was the case and if he fought against the injection, it was not deemed safe to disturb him. The high rectal injections form a very important part of the treatment, especially in the second stage, where the bowel movements are approximately few, because the colon contains a large amount of toxine which is flushed out by this means. In a great many cases, where the patient was complaining of violent cramps in the abdomen, the injections seemed to give relief, so much so that a number begged for their administration. This relief was largely the result of mechanical action from the sudden dilation of the large intestine, but, as careful observation has shown in subsequent hospital experience, benzoyl-acetyl peroxide also has a stimulating effect.

The patients in this hospital were mostly natives and Chinese, and of the lowest type of the inhabitants living in the islands. They had a great dread of the detention camp, of disinfection, and of the destruction of their property; as a consequence, they made every effort to conceal the cases from the sanitary inspectors. Therefore, the greater number of the patients received during this stage of the epidemic had been sick during one to three days and were in a marked state of collapse. Furthermore, the natives and Chinese were unwilling to take medicine of any kind; in many cases great persistence on the part of the nurses was necessary before the capsules were taken, so that the excitement engendered was very deleterious. The road to the hospital was rough and the distance from many parts of the city considerable, therefore, the length of the trip was also a factor in the condition of the patients. These circumstances probably increased the mortality by at least 15 per cent. Of the 6 Americans admitted 4 recovered and only 2 died, both of the latter giving a history of being excessive users of alcoholic beverages. One was admitted after a recent debauch. The belief that the mortality among the natives was increased by the factors mentioned above is based upon the percentage of recoveries among the Americans in this hospital.

The results of the treatment in this hospital are shown in the following table:

San Lazaro Cholera Hospital.

[Schedule showing total cases treated from April 2, 1902, together with deaths and percentages from 1 year, 1 to 12 years, 12 to 21 years, 21 to 40 years, and over 40 years, at 3, 6, 9, 12, 18, and over 18 hours after admission.]

Ages.	Total cases.	Under 3 hours.		3 to 6 hours.		6 to 9 hours.		9 to 12 hours.		12 to 18 hours.		Over 18 hours.		Total per cent.
		Deaths.	Per cent.	Deaths.	Per cent.	Deaths.	Per cent.	Deaths.	Per cent.	Deaths.	Per cent.	Deaths.	Per cent.	
Under 1 year	1	....	.....	1	100.00	....	.....	....	.....	....	.....	....	.....	100.00
1 to 12 years	20	1	5.00	2	10.00	1	5.00	3	15.00	....	.....	6	30.00	65.00
12 to 21 years	20	....	.....	.....	.....	2	10.00	2	10.00	....	.....	5	25.00	45.00
21 to 40 years	54	10	18.52	5	9.26	3	5.55	4	7.41	6	11.11	14	25.93	77.78
Over 40 years	25	2	8.00	6	24.00	4	16.00	2	8.00	....	.....	5	20.00	76.00
Total	120	13	10.83	14	11.66	10	8.34	11	9.17	6	5.00	30	25.00	70.00
		22.49				47.51								

Following the method in vogue in epidemics in India, the mortality percentage is calculated upon deaths taking place six hours and more after admission; those dying before the expiration of six hours, being in a moribund condition upon entering, are consequently not subjects for treatment. The mortality of patients dying after six hours in this hospital was 47.51; the total number of patients received being 120. Treatment with benzoyl-acetyl peroxide was used exclusively after the expiration of the first five days. The total mortality in this hospital, including all patients admitted, whether the deaths occurred over or under six hours, was 70 per cent, whereas at that time the total cholera mortality in the city was above 78 per cent.

The hospital, during the time in which benzoyl-acetyl peroxide was used, was in charge of Dr. James W. Jobling, to whose untiring efforts and continued attention much of the success was due, Dr. Jobling being ably assisted by Dr. T. K. Hunt.

In the first part of April it became evident that the San Lazaro Hospital was becoming infected, it being in tents, and in a more or less exposed locality, and the board of health decided to establish a new tent hospital at Santa Mesa. This was opened on April 12, and both the detention camp and hospital were finally placed in charge of Dr. Thomas R. Marshall, whose earnest work deserves the highest commendation. The records of treatment show that three methods were adopted:

First. Benzoyl-acetyl peroxide.

Second. Benzoyl-acetyl peroxide mixed with other remedies; and

Third. Remedies other than benzoyl-acetyl peroxide.

The results are as follows:

The number of patients treated in the Santa Mesa Cholera Hospital from April 12 until May 5, inclusive, was 186, of which 152 died and 34 were discharged cured. The condition of the patients was much the same as in San Lazaro, the long trip and duration of sickness before admission being deleterious. In this institution only a certain percentage of cases was treated with benzoyl-acetyl-peroxide solution and capsules, other measures being used with the balance, the three classes being kept separate. The doctors in charge reported irritation of the stomach as being produced by the capsules, which did not appear to be the case with the patients treated at San Lazaro.

"The introduction of the drug along the intestinal canal was the end desired. The administration of the powder by mouth in single capsules soon gave place to the use of double capsules, and this was maintained as routine treatment in doses from 0.20 to 0.32 gr. every two to four hours. Gastric irritation was a common symptom presented, and drugs directed to meet this indication were continually employed. It was observed very early that benzoyl-acetyl peroxide was best retained on an empty stomach, for when given on a full stomach retching and frequently vomiting occurred. This prevalency of periodic gastric intolerance to anything foreign greatly interferred with the proper and regular administration of the drug in this hospital." [a]

[a] Report of Dr. T. R. Marshall.

This effect was subsequently avoided in Santiago Hospital (established on May 5), when the method of coating the capsules with two layers of celloidin was adopted. It is difficult to explain why the patients of the Santa Mesa Hospital only suffered from marked gastric irritation after taking the drug. Perhaps the cause of this is to be found in the fact that the benzoyl-acetyl peroxide was delivered at a great distance from the laboratories, and therefore probably melted in the capsules, after which the action of the air and the heat of the sun facilitated hydrolysis, which, once inaugurated, would continue rapidly if the hyperoxide was kept in contact with the moisture and imperfectly cooled. The absorption of water through the coating of the capsules and the consequent hydrolysis would produce acetoperacid, which is irritating, and the effects of which would become apparent in the stomach. Coating with celloidin and preserving in pasteboard boxes covered with oiled paper avoids this difficulty. Despite these obstacles, the statistics of this hospital demonstrate that the best results were obtained with the benzoyl-actyl-peroxide treatment. This becomes apparent by the study of the following table:

	Per cent.
Total number of cases	186
Total death rate	81.7
Total death rate of patients living over six hours	48.9
Total death rate of patients living under six hours	28.4
Died before arriving	4.3

Of these patients, 93 received benzoyl-acetyl-peroxide treatment, either by rectal injections, by capsule, or both, together with cardiac stimulants, hot applications, enemas of normal salt solution or saline transfusion, 29 received other treatments, and 17 a mixed treatment, using benzoyl-acetyl peroxide only as enemas, 8 no treatment at all, and of 39 there is no record. Of the 93 cases treated with benzoyl-acetyl peroxide, 26 recovered; of those who received benzoyl-acetyl peroxide mixed with other remedies, 7 recovered; and of the 29 patients not receiving benzoyl-acetyl peroxide, none recovered. The benzoyl-acetyl-peroxide treatment, therefore, has a total death rate of 72 per cent, as against a death rate of 100 per cent for treatments which contained no benzoyl-acetyl peroxide. The fact must be taken into consideration, however, in this connection, that a number of the cases not receiving benzoyl-acetyl-peroxide treatment were practically moribund at the time of admission, so that the death rate of 41.1 is recorded for these patients under six hours. The above comparison does not of necessity represent the germicidal value of the drug, because stimulation, heat, diet, nursing, etc., have no credit in the statistics for the good they probably rendered, but some conclusions can be drawn from the death rate of those patients receiving no benzoyl-acetyl peroxide.

The treatment resorted to in this hospital consisted, quoting from the report of Dr. Marshall, "in giving 1:1000 solution by mouth and rectal injection. By mouth it was soon discontinued, due to gastric intolerance; but by rectal injections beneficial results were evident. This was soon increased in efficiency by the addition of normal salt solution to an equal quantity of 1:1000 solution of benzoyl-acetyl peroxide, which finally became a routine treatment. Of the treatments where the benzoyl-acetyl peroxide was used it was not the only factor, the patient being given enemas, strychnine, hot applications, and whisky or brandy, in some cases small doses of caffein being used."

The records of the first few days of this hospital were unfortunately not complete, so that absolutely definite conclusions as to the value of the various treatments can not be reached from this report only.

The hospital at Santa Mesa, being in a situation far removed from the city, was finally abandoned, and on May 5 the board of health secured ample quarters in the Santiago Hospital, where facilities for treating patients were much superior to those which were previously available, and where a systematic comparative treatment could be inaugurated. The Santiago Hospital was in the able hands of Dr. E. A. Southall during the first month; subsequently, after his illness, Dr. Lindley took charge. Both gentlemen worked with the greatest zeal, and developed a number of new features of treatment.[a] In this they were assisted by Dr. Jobling, who acted as bacteriologist. As a result of experience they finally developed the following practice: When a patient was not in a moribund condition as a result of the violent toxæmia produced by cholera, but was in the second stage or state of collapse, it became the practice among the attending physicians to resort to subcutaneous injec-

[a] The results and statistics from the Santiago Hospital are taken from reports by Drs. Southall and Lindley. Dr. Southall covered the period up to June 17, and Dr. Lindley the remainder, including the statistics.

tions of normal salt solution, ½ liter combined with a like amount of benzoyl-acetyl peroxide solution of 1:1,000. The point selected for the injection was usually the breast. It was observed that the stimulating effect of the normal salt solution combined with the benzoyl-acetyl peroxide was more direct and lasting than that of the normal salt alone, the combination acting as a decided stimulant upon the circulatory system, and increasing the volume and force of the blood current. The drug appeared to act as a stimulant upon the respiratory system and no marked effects were noted upon the nervous system.

Capsules, double coated with celloidin and containing each 2½ grains of benzoyl-acetyl peroxide were found to pass through the small intestine undissolved and were in some instances recovered from the feces, having lost about 2 grains of the drug during their passage, and thus, by osmosis, the hyperoxide was gradually distributed along the length of the intestinal canal. High rectal enemas of benzoyl-acetyl peroxide, 1:2,000, were given in a large proportion of the cases and no ill effects were noted from this method of administration excepting a nervous excitement incident to the passage of the tube, in a few cases.

In 2½ per cent of the cases of cholera treated in this hosptial evidence of intestinal hemorrhages were seen at the time of admission, the blood passed being usually slight in amount, and it was not observed that the benzoyl-acetyl peroxide in any way influenced the amount or gross appearance of the hemorrhagic stools, save by the possible action of flushing out the large bowel and rectum. This lavage of the large bowel was in many instances followed by decided relief from pain and a diminution of restlessness and semidelirium, this having also been observed in the previous hospital at San Lazaro.

The use of alcohol as a stimulant was discontinued in many instances in this hospital as the mental, physical, and emotional excitement was followed by a grave reaction. A careful administration of strychnine was prescribed in most cases of collapse, accompanied by the use of hot-water bags, hot-water bottles, etc., atropine being used to give relief in cases of sudden collapse. Alcoholic baths were administered, where indicated, and enemas of benzoyl-acetyl peroxide mixed with normal salt at 44° to 45° C. were also employed. Alcoholic stimulants in the form of sherry and malaga wine were only resorted to at the time of convalescence.

The only other treatment used by American physicians, as the table will show, which can come into consideration in addition to benzoyl-acetyl peroxide alone is the one with guiacol carbonate and calomel mixed with the peroxide. The guiacol carbonate and calomel is administered in doses of $\frac{1}{10}$ grain of calomel to 3 grains of guiacol carbonate in powder every four to six hours, and it markedly lessened the bowel movements. The drug had very little effect upon the circulatory, respiratory, and nervous systems, with the exception, perhaps, of a slight reduction of temperature in some instances. A much larger percentage of cases treated by other methods died, so that the American physicians in attendance finally decided in favor of using benzoyl-acetyl peroxide. The treatment with this substance, as outlined above, is now exclusively used with American patients, but the native physicians, who have been in charge of the Filipino wards for the past few weeks, have not, as yet, attempted to use it, but have confined themselves to other methods.

The guiacol carbonate and calomel treatment alone was used up to the date of writing in 54 cases, and shows a percentage of recoveries of 14.18; against this, benzoyl-acetyl peroxide, mixed with guiacol carbonate and calomel had a total recovery of 41.94 per cent and benzoyl-acetyl peroxide alone of 40.42 per cent. These tables would show a slight advantage in favor of the mixed treatment, but the death rate for the latter, under six hours, of only 4.49 per cent, as against 16.31 per cent for benzoyl-acetyl peroxide goes to show that in the later stages of the epidemic, when many less severe cases were encountered, the mixed treatment had the advantage, because the patients were in a better condition on entering the hospital. This will be understood when it is remembered that the treatment with benzoyl-acetyl peroxide was inaugurated at the beginning, when the most adverse conditions as to mortality were encountered. The average death rate in the city during June was 86.2 per cent. The mixed treatment was only tried later, when the death rate had sunk to 70 per cent, and would thus gain an advantage in the condition in which the patients reached the hospital. If this circumstance is considered, it is evident that benzoyl-acetyl peroxide alone is at least of the same value as the peroxide mixed with guiacol carbonate and calomel, although the latter apparently does little harm. In this connection it is worthy of note, however, that the percentage of deaths over six hours is only 43.25 for benzoyl-acetyl peroxide as against 53.55 for the mixed treatment. When we consider that patients who die under six hours can scarcely be regarded as having received treatment at all, it is evident that the advantage lies with benzoyl-acetyl peroxide alone. The majority of the patients in this hospital were not treated

by either of the above methods. Four hundred and eight cases were treated with either benzoyl-acetyl peroxide or benzoyl-acetyl peroxide mixed with guiacol carbonate and calomel, and of these 169 recovered; 593 received other treatment, and of these 106 only, recovered.

The following gives a summary of results:

Total cases received	1,031
Cases in hospital	30
Reported upon	1,001

	Benzoyl-acetyl peroxide treatment.		Benzoyl-acetyl peroxide mixed with guiacol carbonate and calomel.		Guiacol carbonate and calomel treatment.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Total cases treated	141		267		54	
Deaths under 6 hours	23	16.31	12	4.49	16	29.62
Deaths over 6 hours	61	43.25	143	53.55	30	55.55
Recoveries	57	40.42	112	41.94	8	14.81

SUMMARY.

	Number.	Per cent.
Total cases treated	1,001	
Deaths	696	69.53
Recoveries	305	30.46

On July 21 certain wards were turned over to native physicians and nurses, who inaugurated treatments which had proven efficacious in the previous cholera epidemic in Manila. These methods have varied considerably from time to time, and, as individual physicians adopted different remedies, details as to the exact measures employed in a given series can not be given. The treatment practically divided itself into two heads: one with saline enemas three times a day and administration of calomel 3 centigrams, tannalbin and bismuth 25 milligrams every three hours; and the second class with tannic acid enemas 1:100, calomel and benzonaphthol every three hours. As stimulants, hypodermic injections of strychnine, sodium benzoate, caffein citrate, and subcutaneous injections of sodium benzoate and caffein citrate combined with one-third normal salt solution were used. The following tables, covering the period between July 21 and September 1, are appended:

	Cases treated by—			
	American physicians.		Native physicians.	
	Number.	Per cent.	Number.	Per cent.
Total cases treated	138		136	
Deaths under 6 hours	17	12.31	31	22.80
Deaths over 6 hours	60	43.48	56	41.19
Recoveries	61	44.20	49	36.02

As will be seen from the above, the native physicians have a very favorable percentage of recoveries, but the total is nevertheless 8.18 per cent of all cases less than that to be ascribed to methods using benzoyl-acetyl peroxide.

Five hundred and three cases are not recorded in any of the above treatments. These can not be classified, as the means employed and remedies administered varied with individual physicians and at different times, many of these cases representing the class of patients who where brought into the hospital in a moribund condition and who received no treatment at all. None of them received benzoyl-acetyl peroxide. The percentage of recoveries with this remainder was 14.3. The total percentage of recoveries for the entire hospital was 30.46.

BENZOYL-ACETYL PEROXIDE IN AMEBIC DYSENTERY.

Benzoyl-acetyl peroxide has given very satisfactory results in amebic dysentery. In the treatment of this disease one should recall that not one but two factors are concerned in the etiology of the malady, and particularly in its progress. These factors are the amebæ and the intestinal bacteria, both of which must be attacked. In the following, Dr. R. P. Strong, of the biological laboratory, reports the results obtained with 11 cases:

"It has been demonstrated in the biological laboratory, by experimental studies on cats, that the bacteria in the intestine, always present, and other varieties of microorganisms occasionally present, may play an important part in the extension of the lesions in amebic dysentery, and that it is particularly to their influence that the necroses found in the intestine in this disease are due. Bacteria are always plentiful in the sections from experimental dysenteric cases, and in very large numbers in the necrotic areas. The same is true in sections of the intestine in human dysenteric cases. While it seems probable that the amebæ proceed in advance of the bacteria, and make openings for them in the mucosa, the latter, however, closely follow them, modify the lesions, and cause increased tissue destruction. Particularly is this true when the pyogenic cocci are present in large numbers, and, indeed, the immediate cause of death in the disease may be due to these microorganisms.

"Quinine used in enemeta has hitherto usually given the best results in the treatment of amebic dysentery. The advantages of benzoyl-acetyl peroxide over quinine, however, are apparent, for the latter, while quite capable of killing amebæ, even in dilute solutions, also attacks the bacteria which are present in the intestines, and it has been found possible by its use to greatly reduce the number of microorganisms in the stools.

"Benzoyl-acetyl peroxide is therefore now used for the routine treatment of this disease in the following manner:

"The patients take daily, or in some cases oftener, a 1:1000 solution of the drug in enemeta, from 1 to 2 quarts being slowly injected through a long rectal tube, which is introduced its entire length. The hips of the patient are elevated during the operation. In addition to this treatment, 5 grains of the drug, inclosed in a celloidin capsule, are administered three times daily. Such treatment has been continued in a number of cases for over two months, with decided benefit and with no unfavorable results.

"In addition, a number of patients have been given a 1:1000 solution of benzoyl-acetyl peroxide to drink ad libitum, and in fact some of these have taken no other liquid for several weeks.

"The other treatment has consisted in the use of occasional purgatives, such as calomel or Rochelle salt; and for symptoms requiring it, some form of opium has occasionally been employed, usually in the form of Dover's powder.

"So far, the results have been very encouraging. There have been 11 cases treated. Two of these have died, one from a complication of a liver abscess. The remaining nine are at present doing well and are without any symptoms of the disease. The opportunity for the trial of this drug in cases of acute infectious bacillary dysentery has not as yet presented itself, as no epidemic of this disease has occurred in the city this year. It is probable that benzoyl-acetyl peroxide will be of particular value in the treatment of this variety of dysentery."

THE BIOLOGICAL LABORATORY.

Continued experience of colonial governments in the Tropics, extending over a large number of years, has demonstrated that the people of these regions are especially prone to devastating epidemics of infectious and contagious diseases. So long as the suggestion of prophylactic treatment is solely in the hands of isolated physicians in the various communities, concerted action and satisfactory results can not be obtained, and for this reason all of the interested governments have from time to time established laboratories for the study of tropical diseases, or have even at great expense equipped expeditions to travel to the seat of the disease, there to make studies and report to the home government. The result has been, as was pointed out in the discussion of the needs of the chemical laboratory, in many cases a duplication of institutions within the limits of the same colony, and an obviously inevitable loss of time and efficiency. The Philippine Islands are as prone to epidemics as other tropical countries. We have, within the brief existence of the present government laboratories, been in contact with bubonic plague, cholera, rinderpest, surra, amebic dysentery, and other diseases peculiar to the Tropics, and it is gratifying to note that the board of health, physicians, and other parties interested, have,

with increasing reliance on the results obtained, applied to the government biological laboratory for relief and assistance.

The laboratory has been organized on the sound principle of the establishment of a central institution under one director, and although up to the present time the apparatus and supplies have been unsatisfactory and the scientific corps inadequate, it has been able in large part to meet the demands that have been made upon it. The value of laboratory work in tropical diseases is of course no longer doubted by anyone, and the advantage to a government, from a financial standpoint alone, provided the laboratories show ways and means of combating epidemics, is inestimable.

In classes of diseases which are of importance not only to the individual infected, but also to the general public health and upon the early and definite diagnosis of which the safety of the community depends in so large a degree, the laboratory must be consulted for a final decision. Examples of such diseases are bubonic plague and Asiatic cholera. The latter before the appearance of an epidemic may be clinically impossible to differentiate from cholera nostras of a severe type; but the laboratory renders the distinction possible and by an early diagnosis enables the authorities to inaugurate vigorous measures. In bubonic plague it is often possible to diagnose the case some time before clinical symptoms have definitely shaped themselves, and early diagnosis is of course an important factor in the suppression of the disease.

In animal maladies, such as surra, glanders, and farcy, the correct and accurate diagnosis may save many individuals which otherwise might be destroyed, and investigations may lead to prophylactic treatment which will save the lives of many more. In rinderpest such methods have already been discovered in the production of a prophylactic serum, and work in this direction, if it enables importers once more with impunity to bring their cattle into the Philippine Islands, will be of such value as to render nominal the cost of equipment and the assistants necessary in its production in comparison with the benefits conferred. When the Serum Institute is thoroughly organized a portion of the expense will be covered in by small charges made for the sale of its product.

The necessity of the biological laboratory has been conclusively shown by these few instances, which could be multiplied almost ad libitum by considering other tropical diseases. It is, however, certain that the mere establishment of a biological laboratory is not sufficient. It must be thoroughly equipped with modern appliances and must have at its command a sufficient force of scientifically trained men to carry on its routine work, to conduct investigations, and to meet any emergency which may arise. Insufficient apparatus, cramped and inadequate quarters, assistants who have to be continually changed from one line of work to another, result in such a loss of time as to seriously cripple the efficiency of the laboratory.

The present equipment, quarters, and staff is entirely inadequate to meet the growing demands, and many important lines of work must be deferred until the completion of the new building.

The needs of the laboratory in regard to a reference library have been mentioned in another portion of the report, and it is only necessary to emphasize again that a working library needs not only the current journals, but also complete sets of those publications from the beginning. The man who is precluded from reading the literature of any subject in which he is engaged may thereby sacrifice many hours of valuable time by repeating work which has already been done. Manuals and textbooks are but compilations which can give only a brief review of the field and can not give that rigid and definite knowledge which alone is the basis for scientific work.

WORK OF THE BIOLOGICAL LABORATORY.

The following report on the work of the biological laboratory is submitted by Dr. R. P. Strong, director of the biological laboratory:

CLINICAL LABORATORY WORK FOR GOVERNMENT INSTITUTIONS.

All the clinical laboratory examinations have been performed for the Civil Hospital, the San Lazaro Hospital, Bilibid Prison, and various cholera hospitals. The following table will give some idea of the number and character of the examinations made:

Clinical laboratory examinations, September, 1901, to August, 1902.

[P=Examinations showing organisms. (Positive.) N=Examinations showing absence of organisms. (Negative.) T=totals.]

	Civil hospital.			Bilibid prison.			San Lazaro Hospital.			Cholera hospitals.			City veterinarian.			Miscellaneous.			Totals.		
	P.	N.	T.	P.	N.	T.	P.	N.	T.	P.	N.	T.	P.	N.	T.	P.	N.	T.	P.	N.	T.
Sputa	19	87	106	20	78	98										76	81	157	115	246	361
Urines			110			3												60			173
Fresh blood specimens for malarial hematozoa	21	211	232													2	19	21	23	230	253
Serum reaction for typhoid fever	3	52	55	0	2	2										4	13	17	7	67	74
Blood counts			111															4			115
Gonococci	6	10	16				437	685	1,122							4	0	4	447	695	1,142
Feces			508			123						946						49			1,626
Ameba dysenteriæ	94			27												9			130	520	650
Ameba coli	4			2												0			6	644	650
Monads	63			2												3			68	582	650
Strongyloides intestinalis	12			0												0			12	638	650
Ova of trichocephalus dispar	18			6												1			25	625	650
Ova of uricinaria duodenale	9			2												0			11	639	650
Ova of ascaris lumbricoides	1			1												0			2	648	650
Tænia	1			0												1			2	648	650
Spirilla of Asiatic cholera	4			1						805						5			815	161	976
Lymphangitis epizootica													14	1	15					15	
Glanders													2	1	3					3	
Surra													42	6	48					48	
Hog cholera													5	1	6					6	
Total			1,138			226			1,122			946			72			312			3,816

Work Relative to Bubonic Plague.

In the autumn of the year 1901 an effort was made on the part of the board of health of Manila to exterminate the rats in the city, particularly because they were suspected of playing an important rôle in the dissemination of bubonic plague, and indeed, especially, because from the organs of the dead bodies of several of these animals the bacillus pestis had been isolated here. The rats were collected and sent to the biological laboratory. In all, 47,635 were examined for this organism. The bacterium of pest was found in the organs of these animals in 166 cases, or in 0.34 per cent. Taking a total average, the highest percentage at any one time was 2.3 per cent. The percentage of infection gradually diminished, and reached naught on January 31. During the time in which the highest percentage of infected plague rats was encountered a large number of these animals were found dead in the plague districts. In almost every instance in which a rat was found infected with the bacillus pestis it was later ascertained that it had been found dead or captured in a house where cases of human plague had occurred. The location of plague-infected rats was the basis for action by the board of health in improving and altering houses.

At first merely cover-glass preparations were made from the spleen, liver, and heart's blood of the rats, and if bacilli of suspicious morphology were encountered, cultures were then taken from these organs and animal inoculations made if necessary. Such a method did not, however, seem entirely satisfactory, and later on an effort was therefore made to perfect this technique, and to prepare cultures in as many cases as possible. The work was a very tedious one, and particularly so because other bacilli somewhat resembling those of bubonic plague have been found here in these animals.[a]

This work was carried out under the direct supervision of Dr. J. W. Jobling, assistant bacteriologist, who deserves great praise for the conscientious manner in which he conducted it. During the last few weeks of the examinations no rat was found infected with plague bacilli, and the work was discontinued on the appearance of Asiatic cholera in Manila. No further comment is necessary on the value of these examinations, which is apparent from the results obtained.

PREPARATION OF PLAGUE VACCINE.

As the serum institute had not yet been established and as the board of health early in the year desired to vaccinate the native and Chinese population of Manila against bubonic plague, it became necessary to prepare the virus for this disease in the biological laboratory. The method of vaccination used was that described and pursued by Shiga, and which consists briefly of the subcutaneous inoculation of a definite amount of plague bacilli of known virulence which have previously been killed by heating for one hour at 60° C. while suspended in normal salt solution to which 0.5 per cent carbolic acid had been added. The method will not be described in detail, as the preparation of vaccines belongs more to the work of the serum institute.

In all, 19,716 doses of plague serum were prepared and delivered to the board of health.

Asiatic Cholera.

The following report to the commissioner of public health cites the appearance of the first cases of Asiatic cholera in Manila:

Manila, P. I., *March 22, 1902.*

The Commissioner of Public Health, *Manila, P. I.*

Sir: I have the honor to inform you as follows in regard to the recent examination of cases of suspected cholera:

During the evening of March 20 I was notified that there were two cases of suspected cholera lying in the San Juan de Dios Hospital. On investigation these two cases proved to be male Filipinos, one about 45 and the other 24 years of age.

It was ascertained that the former had been taken sick early in the morning of March 20, with violent purging and cramps in the abdomen. He had been removed to the hospital, where early in the day the severe diarrhea had continued, and he had complained of cramps in his legs. On examining the patient at 9 p. m., March 20, he was found to be in a state of extreme collapse. The skin was cold and bathed with perspiration. The rectal temperature registered 102°. No pulse could be felt

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[a]See also Edington, British Medical Journal, II, 1901, p. 287.

at the wrist, and the heart sounds were very rapid and feeble. He was already unconscious. An examination of the rectum showed no discharge, and it was stated that there had been no bowel movement for about six hours. A cover-glass preparation was, however, made from the rectal mucosa and examined microscopically. While a few organisms present possibly resembled morphologically the spirillum of Koch, the majority did not suggest this organism.

An examination of the other patient (Case II) showed a somewhat similar condition to the first. He was still, however, conscious, and stated that he had been attacked with severe diarrhea, cramps, and vomiting the previous night (March 19). There had been no diarrhea since morning. He complained of great thirst and the voice was very husky. The skin was cold to the touch, and no pulse was perceptible at the wrist. An examination of the chest showed rapid, feeble heart sounds. The abdomen was retracted.

These cases were regarded as very suspicious ones from a clinical standpoint, but as attacks of cholera nostras have occasionally been observed before in Manila, a bacteriological examination was most desirable. As there was also no discharge from the bowels in this case, and no soiled linen among the bed clothes, an attempt was made to secure a rectal speculum, or rectal tube, in order that satisfactory material for a microscopical examination might be secured.

At this time, while a search was being made in the hospital for these instruments, a telephone message was received, stating that a native had just died under suspicious circumstances in one of the districts near by, and that the body was then on the way to the morgue. The further examination of Case II was, therefore, deferred in order that an autopsy might be performed on Case III as soon as possible.

Case III.—The necropsy on this case took place about an hour after death. The body was still warm, but rigor mortis was already marked. The following is a brief summary of the more important changes found present:

The intercostal muscles were dry and red in color. The right chambers of the heart were distended with dark, clotted blood. The bases of the lungs were congested. Upon opening the abdominal cavity, the serosa of the ileum and jejunum presented a rose-pink color. The small intestine was dilated, but the large bowel was contracted and pale grayish in appearance. The blood vessels of the small intestine were markedly injected. On opening the ileum a large amount of watery fluid containing whitish flakes escaped. The solitary follicles were swollen and reddened, particularly at their margins. There were many small diffuse hemorrhages in the mucosa. This process continued nearly through the jejunum. The mucosa of the large intestine was in general pale gray in appearance, but its vessels were injected and numerous small hemorrhages were present. The spleen was small and firm. The capsules of the kidneys stripped easily. The kidneys were much conjested and their surface vessels deeply injected. The stomach was distended with gas and contained a small amount of fluid. Its mucosa showed a few small superficial hemorrhages. The liver showed moderate cloudy swelling. The mesenteric glands were not particularly swollen. Cover glass preparations were made from the mucosa of the ileum and from the spleen. Those from the latter were negative for organisms. The former showed a number of comma-shaped bacteria, but there were also a large number of other organisms present. Cultures were made from the spleen and from the small intestine in Dunham's solution.

Shortly after midnight and just before the completion of the above autopsy, a second case was brought to the morgue.

Case IV.—This body was also examined. Moderate rigor mortis was present. The abdominal cavity was free from fluid. The spleen was small and firm. The liver showed cloudy swelling. There was moderate atheroma of the arch of the aorta and congestion of the lower lobe of the left lung. The vessels of the mesentery and of the small intestine were deeply injected. The mucosa of the latter showed numerous diffuse bright red hemorrhages, but the swelling of the solitary follicles was not so marked as in Case III. The mucosa of the large intestine also showed numerous hemorrhages, but was elsewhere in general pale in color. Cultures were also made from the intestines of this case.

On arriving at the laboratory, plate cultures were made from the Dunham's tubes inoculated with material from the small intestine of Cases III and IV. At 9 a. m. of the same day an examination of the culture tubes inoculated from the spleen showed no growth. In those from the small intestines of Cases III and IV there was a distinct cloudiness of the media. Hanging drop preparations made from the top of the media showed a motile bacterium often curved in shape and occasionally appearing in S-shaped forms. Stained preparations showed a comma-shaped organism measuring about 4 μ in length by 0.4 μ to 0.5 μ in thickness. Preparations made from the colonies which had developed on the plates inoculated with intestinal material showed the spirillum to possess but a single terminal flagellum. Several

large loops from the plate colonies were suspended in 1 c. c. of salt solution and injected into the abdominal cavity of a guinea pig. The same amount was injected into the breast muscles of a pigeon.

Cultures in glucose agar and Dunham's solution were prepared from colonies on the plate cultures, and in the latter media also from the upper portion of the original tubes of peptone solution inoculated from the intestine at necropsy. On Friday afternoon the Dunham's tubes all showed a marked indol reaction on the addition of specially prepared nitrite-free sulphuric acid, while the glucose-agar tubes showed no gas production.

It was, therefore, reported verbally to the board of health that probably the spirillum of Asiatic cholera had been isolated.

On Saturday morning the guinea pig was found dead. During the afternoon before, its temperature had been subnormal. On autopsy there was a large amount of cloudy serous fluid in the abdominal cavity. A hanging drop preparation showed very large numbers of comma and spiral shaped bacteria, all clumping in the serous exudate. The pigeon was still alive and has since remained well.

Case I died on Friday morning, and the autopsy showed in general a somewhat similar condition to that observed in Cases III and IV. The large intestine, however, showed more numerous and extensive hemorrhages. There was a large amount of rice-water material in the small intestine. Cover slip preparations from a floccule of mucus in the ileum showed almost a pure culture of coma and spiral-shaped organisms. Cultures in this case have revealed an organism similar to that isolated from Cases III and IV.

Case II is still alive and apparently recovering.

I therefore have the honor to inform you that cases of Asiatic cholera have occurred in Manila, and that the spirillum of Koch has been isolated and obtained in pure culture from these cases.

Very respectfully,

RICHARD P. STRONG,
Director of the Biological Laboratory.

Notwithstanding the occurrence of a considerable number of cases shortly after this report, the presence of Asiatic cholera in Manila was still doubted by many. In fact, it was apparently generally doubted by the native population, and several of the native physicians informed us that this disease "came every year before the rains and was not true cholera." For the purpose of the study of the disease, and in addition, to convince these people, particularly the physicians, that the deaths were really from Asiatic cholera, autopsies were held on all the dead brought to the morgue. On April 2 the following letter was received from the commissioner of public health:

MANILA, P. I., *April 2, 1902.*

Lieut. RICHARD P. STRONG,
Director of the Biological Laboratory, Manila, P. I.

SIR: I have the honor to request that you furnish me with a report of cases of cholera examined from the beginning of the epidemic to March 31, with statement as to what you have found and whether the disease is actually Asiatic cholera or not. A brief report from you on this subject is necessary for the reason that a large number of the people in the city of Manila, among whom are some physicians, including several Americans, do not believe that Asiatic cholera exists at present in the city of Manila, and are disquieting the people to a certain extent for this reason.

Very respectfully,

L. M. MAUS,
Commissioner of Public Health.

To this communication the following reply was sent:

BIOLOGICAL LABORATORY,
Manila, P. I., April 2, 1902.

The COMMISSIONER OF PUBLIC HEALTH, *Manila, P. I.*

SIR: In reply to your communication of April 2, I have the honor to inform you that since the outbreak of Asiatic cholera in the city of Manila on March 20, 1902, autopsies have been performed on all bodies brought to the cholera morgue. In 84 of these cases, the pathological-anatomical lesions of Asiatic cholera have been found present. Pure cultures of the spirillum of Asiatic cholera isolated from them, as well as the anatomical material collected from them, may be seen by physicians at the government biological laboratory.

Very respectfully,

R. P. STRONG,
Director Biological Laboratory.

Careful records were kept of the first 200 necropsies. Later, when the deaths became so frequent, this was no longer practicable with the quantity of other work there was to be carried on, and autopsies were performed merely for a definite diagnosis of cases, and were omitted in a number of those from the hospitals in which the diagnoses were conclusive during life. Over 1,000 necropsies have been performed.

CLINICAL LABORATORY DIAGNOSES OF CASES OF CHOLERA.

Owing to the quarantine regulations and restrictions placed by the board of health upon those afflicted with cholera and upon the houses in which cases of cholera had occurred, it became necessary to have early, definite, and indisputable diagnoses made and the laboratory performed this work. Various methods of procedure were tried. Agglutinative tests with the serum of those infected and the spirilla of Koch often gave doubtful and negative results, and it was found impossible to rely upon this test for the final diagnosis of cases even well marked from a clinical standpoint. Experiments for agglutination made with the admixture of serum from cholera cases and normal human serum also failed to give satisfactory data for diagnosis. For routine work, however, the bacteriological examination of the stools by cultural methods gave the surest and most conclusive results, although in many cases mere cover slip preparations from them showed almost pure cultures of cholera spirilla. For the cultural method several oeses of the suspected stool were placed in a test tube of Dunham's solution and thoroughly mixed. After from eight to ten hours two or more tubes of Dunham's solution were inoculated with two oeses each, made from the surface of the original tube of this medium. At the same time a hanging drop and cover-slip preparation were made from the surface growth of this tube. If spirilla of similar morphology to Asiatic cholera were found to be abundant, no further cultures were made from it; but if there were few spirilla, or their form was doubtful, then plate cultures were also prepared from the surface growth in the original tube. After the two tubes of Dunham's solution inoculated from the surface of the original tube had been placed in the incubator for from eight to twelve hours they were removed and a few drops of specially prepared nitrite-free sulphuric acid were added to one of them. If the so-called "cholera-red" reaction appeared and the morphology of the organisms in the parallel tube was correct, a bacteriological diagnosis of cholera was made. If there was no nitroso-indol reaction, the colonies on the original plate cultures were worked over, or if these had not been made, they were prepared from the surface of the parallel tube to which sulphuric acid had not been added. If from all of these no spirilla were obtained, a negative bacteriological diagnosis of cholera was made. For routine work during an epidemic of cholera this method seems satisfactory. However, in almost all cases in which the cholera spirilla are present in the original stool the nitroso-indol reaction is obtained in the second Dunham's tube, though it is necessary that the proper peptone should be used in preparing this medium. Of the varieties used, Grubler's has given us by far the most satisfactory results. De Witte's often gave but a feeble reaction, and Merck's, Bausch & Lomb's, and Nishyama's practically proved to be of no value in obtaining this reaction for diagnostic purposes. The task of isolating cholera spirilla either from the intestinal tract or from stools usually proved an easy one, and particularly did it seem so by comparison with the careful search we have often found it necessary to make for bacillus dysenteriæ in the intestines or stools of those suffering from epidemic bacillary dysentery.

While during an epidemic the clinical diagnosis in many cases of Asiatic cholera is as definite as it can be in any disease, and a bacteriological diagnosis is almost superfluous; and while a diagnosis in some cases can scarcely be made during the life of the patient (for, as Andral has aptly remarked of the malignant form, "It begins where other diseases end—in death"), nevertheless, in a large number of other cases the diagnosis is not only difficult but impossible without the bacteriological isolation of the spirilla; and we have all seen many instances during this epidemic which we were entirely unable to diagnose from a clinical standpoint alone.

INVESTIGATIONS IN REGARD TO THE ÆTIOLOGY AND DISSEMINATION OF THE DISEASE IN MANILA.

In the early days of the epidemic, when the so-called Farola district was apparently well infected and a number of cases had occurred there, visits were made from house to house and cultures taken from various foods and from numerous samples of water found in these houses, as well as from linen and articles of clothing collected there. In these cultures we were more successful in isolating the spirilla of Asiatic cholera than in those taken later in the epidemic. Out of 311 cultures the cholera spirillum was obtained from seven. The positive ones were: One from a

dish of mixed rice and fruit, which was found on the floor alongside of a cholera patient; one from a barrel half full of water, located just outside of a nipa house, in which four cases of cholera had occurred, and five from cultures made from linen collected from these houses, which had probably been used to cover the sick patients. In other portions of the city where cholera was prevalent cultures have in like manner been made, particularly from various food stuffs, and also from other articles found in the houses where the cases had sickened. Some rather curious instances were encountered in regard to the examination of these food stuffs. In one Spanish convent in which we happened to be present a large cold ham had been prepared for a meal. This, on being cut in our presence, was found to contain several living diptera (maggots) in each of the slices. The authorities of the convent seemed to resent its destruction. Altogether, including the examination of food stuffs in these houses and from the various markets, 1,134 cultures have been made. Cholera spirilla have been isolated in but three of these cases—in two cases from dishes of mixed hashed foods, and in one case from a small earthen jar containing a pea-soup-like liquid. The method used in the isolation of the spirillum from these articles was as follows: An emulsion of the suspected substance was made in a tube of Dunham's solution, after which the procedure was similar to that used and described for the isolation of the cholera spirillum from feces.

EXAMINATION OF THE CITY WATER SUPPLY.

The city water supply has been under constant surveillance since the beginning of the epidemic, but at no time has it been found by bacteriological examination to be infected with cholera spirilla. The method of examination has been as follows: Three hundred cubic centimeters of suspected water were added to 100 c. c. of double-strength peptone (2 per cent solution), containing 1 per cent of sodium chloride. The mixture was then incubated in an Erlenmeyer flask for from eight to twenty-four hours and plate cultures were then made from the surface growth. After from eighteen to twenty-four hours the colonies developing on the plates were studied morphologically. A portion of each colony which consisted of spirilla was then planted on gelatine, glucose-agar, agar slant, and peptone solution. After twelve hours the indol reaction was tested in the peptone tube. So far no organism found in the water has resembled the spirillum of Asiatic cholera sufficiently to make animal inoculations necessary for its determination, though several spirilla resembling it in morphology and somewhat in cultural characteristics have been encountered.

EXAMINATION OF WATER FROM WELLS.

Upon the request of the board of health the waters from ninety-three wells have been submitted to bacteriological study. In no case has the cholera spirillum been found present, though in six the wells were found to have been probably contaminated with fecal discharges, as was shown by the large amount of nitrates and nitrites which these waters contained, and from the fact that varieties of colon bacilli were isolated from them. In examining the incubated flasks containing the water from several of these wells, mixed with peptone solution with nitrite-free sulphuric acid, the nitroso-indol reaction was obtained. The cholera spirillum was not, however, found in them, but the colon bacillus was recovered, and the action of the latter organism on the media, together with the nitrite present in the water, evidently gave rise to this reaction.

In the examination of the city water supply, while, as has been stated, cholera spirilla was never found, it is interesting to note that amebæ and several varieties of mastigophora were frequently cultivated in large numbers. Amebæ were found in about one or two out of every four or five examinations. While the evidences of the pathogenesis of these varieties of sarkodina were not demonstrated, their presence merely shows how very unsafe the use of this water for drinking purposes should be considered, unless it has been thoroughly boiled or filtered.

THE STUDY OF FLIES.

As well-authenticated cases are related in which flies have appeared to carry the infection from cholera dejecta to various articles of food, an experimental study was made in regard to the ability of these insects to convey the disease. Out of 27 house flies (Musca domestica) fed upon fresh cholera stools, cholera spirilla were isolated from the intestines of 13 after twenty-four hours. Out of 318 flies captured in the bedrooms and about the houses where cholera cases had occurred, only one was found to be infected and this one was captured while feeding upon a cholera stool in

a receptacle. Doubtless, during this epidemic of cholera, these insects have served to disseminate the disease to a small extent, but the early disinfection and close watch kept over excreta in cholera cases has probably served to reduce this to a minimum.

RÉSUMÉ.

From these experimental studies, we are inclined to believe the chief means of dissemination of Asiatic cholera during this epidemic to have been through food stuffs. In support of this are the facts that cholera spirilla have been isolated from certain articles of food, while we have failed to isolate them from water except in one instance, in which the barrel containing the water was probably infected secondarily in some way. Also the fact that the cases have usually occurred successively, and that large numbers of people have not been attacked simultaneously, as they were, for example, in the Hamburg epidemic, argues against the idea that the disease has spread through the water supply.

Cholera organisms were on several occasions isolated from linen and bedclothes found on the floors of cholera houses, and, as is well known, the natives often cover their fruit with cloths while taking it to market. This, perhaps, offers a fair explanation of one means of the dissemination of the disease. As is well known, in spite of the quarantine on a great many fruits, many people almost entirely subsisted upon this diet, even if certain kinds were not placed in the markets for sale. The early disinfection in the houses in which cholera cases have occurred has seemed to be the most important and efficient means the board of health has adopted in limiting the spread of the malady, which again argues against the infection of the general water supply as being the chief means of the dissemination of the disease.

It may be added that in several cases occurring in intelligent individuals it has been impossible to get any history of their having drunk any unboiled water, and as they were the only individuals of the household attacked, there is a possibility in these cases that some single article of food of which they had partaken had been infected through flies.

It has been interesting to note the effect which the humidity has had upon the epidemic and to observe how with each marked rise the number of new cases has increased.[a] The dark and cloudy days are evidently more favorable to the biology of the cholera spirillum than those on which the sun shines and when the disinfecting powers of its rays are more strongly felt.

Dengue Fever.

During the past few months this disease has been very prevalent in Manila, and some experimental work has been performed in regard to its etiology.

As early as 1885 J. W. McLaughlin,[b] in a study of an epidemic of the disease occurring in Texas, held that he had discovered and isolated the specific organism from the blood of the patients affected. It was claimed that this organism, a micrococcus, was found both in fresh cover-slip preparations and in cultures taken from the blood. The unique feature of this coccus, according to the author, was the peculiar manner in which the bacteria grouped themselves when grown on artificial media. The blood of the patient was used first as a culture media for the organism contained therein. In 1897, in another epidemic of dengue fever in Texas, Gamon took up this work and succeeded in isolating a coccus from the blood of one case, which, however, presented some differences from the organism described by McLaughlin, and which the author considered perhaps a variety of one of the pus organisms. It was, however, not pathogenic for rabbits in large doses. No further confirmation of this work has been made.

Quite recently H. Graham, [c] in an epidemic at Beirut, Syria, has claimed to have found an ameboid form in certain of the red blood corpuscles of those sick with the disease, and subsequently he was able to discover it after careful examination in all of the cases, without exception, which he examined. One hundred cases were studied. He describes this parasite as resembling in many ways the plasmodium malariæ, or particularly Pirosoma bigeminum, but its cycle of reproduction is so much longer than that of the malarial parasite that it is difficult to follow. It may be seen either in the center of a red blood corpuscle or sometimes at the margin.

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[a] Dr. Southall has prepared a chart which admirably illustrates this point. This will appear in the report of the board of health.

[b] Dengue Fever, System of Practical Therapeutics, Hare, Vol. II, 1901.

[c] Medical Record, February 8, 1902.

From time to time it changes its shape, showing ameboid movement and shifting its place from one part of the corpuscle to another. This hematozoon is unpigmented. Flagellated forms are described, which, however, only developed after the blood had stood for some time. The author states that the parasite need not be mistaken for a vacuole, as it is too dull in color and lacks the clear brightness seen in a vacuole.

During the present epidemic in Manila we have carefully sought for this plasmodium in the blood, and attempts have also been made to isolate the coccus which McLaughlin described. From our studies on the blood in this disease we have arrived at the following conclusions: (1) In dengue fever there is no leucocytosis. (2) The differential counts of the white corpuscles in this disease show normal proportions of the several varieties. (3) The hematozoon described by Graham has not been found present in the circulating blood of our cases. (4) The micrococcus described by McLaughlin has not been encountered. (5) The etiological factor in this disease is as yet unknown. Experiments are now being undertaken to determine whether the disease is disseminated by mosquitos, as Graham has claimed.

INTESTINAL PARASITIC DISEASES.

INFECTIONS WITH STRONGYLOIDES INTESTINALIS.

There have been 12 cases of infection with *Strongyloides intestinalis* encountered during the past six months. All of these patients have suffered at times with intestinal disturbances. Intermittent diarrhea has been the most constant symptom, in some, however, of a very mild type. One patient complained considerably of attacks of vertigo. During the previous year I reported 13 cases of infection with this parasite occurring in Manlia.[a] We, therefore, have now had 25 cases under our observation. Notwithstanding the fact that many of our text-books of medicine apparently attach little importance to *Strongyloides intestinalis*, with our present knowledge concerning the parasite, it does not seem as if we can be justified in considering it an innocent commensal of man. While in cases of moderate infection the symptoms of the disease may be very slight or even wanting, as they are, indeed, sometimes in mild cases of ankylostomiasis, yet when we study the histological sections of the small intestine from those who had been infected during life and for long periods of time with this parasite, we usually find distinctive changes. Golgi and Monti[a] and the author[b] have described lesions in the mucosa of the small intestine consisting chiefly of catarrhal inflammation with desquamation and in many places atrophy of the epithelial cells. Sonsino[c] also found the parasites in the mucosa of the small intestine. In two cases of the author[b] the solitary follicles were also swollen, and there were infiltrations of small round cells about the glands containing the parasites. All through the mucosa the adult forms together with their ova and embryos were found. In some cases the embryos were situated beneath the epithelium of the villi. More recently Askanazy[d] has demonstrated that the worms may penetrate into the mucosa and sometimes into the submucosa, and *O. Leichtenstern*, in a letter to Askanazy, states that in another case he also observed the parasites to have entered into the submucosa. During the past year M. V. Kurlow[e] has reported another case of bloody diarrhea in which characteristic changes were also found in the small intestine. The parasites were situated in and beneath the mucosa. In the light of such observations regarding the pathology of this infection we can see no reason to change our views in regard to the pathogenesis of the parasite. Clinically, when present in large numbers and for considerable periods of time, it is probably capable of causing intestinal disturbances, of which intermittent diarrhea is the most common symptom. Anatomically, an intestinal catarrh is produced. All the evidence thus far submitted seems to show that it is by the mechanical action of the parasite that the disturbances arise. Probably cases of mild infection continue for long periods of time with no apparent symptoms.

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[a] Strong: Circulars on tropical diseases, February, 1901, Manila, P. I.

[b] Note sur une question helmintologique. Archives Ital. de Biologie, V, p. 395.

[c] Cases of infection with *Strongyloides intestinalis* (first reported occurrence in North America), The Johns Hopkins Hospital Reports, Vol. X, Nos. 1-2.

[d] The casi di malattia da *Rhabdonema intestinale* e Rhabdonemasi. Riv. gen. Ital. di clin. med., Pisa. Supl., 47-56 (Jul. 20).

[e] Centralblatt f. Bakteriologie, etc., I, Bd. XXVIII, 1900.

ANIMAL DISEASES.

SURRA.

During my absence in America, in the latter part of October, 1901, Dr. Slee, assistant veterinarian of the board of health, brought to this laboratory a specimen of blood from a horse suffering from an unrecognized disease. This was examined by Dr. J. W. Jobling, assistant bacteriologist of the laboratory, and a parasite was found therein. Upon receiving this information, the malady was studied by Asst. Surg. A. M. Smith, U. S. Army, and Surg. J. J. Kinyoun, U. S. Marine-Hospital Service, and reports were made of the disease. Later the affection was recognized as surra, and it was found that carabao here were also afflicted. Recently this disease and other forms of trypanosomiasis have attracted considerably the attention of the scientific world. Among the investigators that have contributed during the past and the present year to the literature regarding these subjects may be mentioned: Salmon and Stiles,[a] Laveran and Mesnil,[b] Nocard,[c] Rogers,[d] Voges,[e] Jurgens,[f] Schilling,[g] Rost,[h] Leger,[i] and in the Philippines, Smith and Kinyoun, and Curry and Slee. Drs. Salmon and Stiles, in their Emergency Report on Surra, have reviewed the literature of the subject up to March, 1902. This is the most exhaustive report that has as yet appeared and is one of inestimable value. The reader is referred to it for any knowledge desired regarding the malady up to the date of its publication. Since its appearance, Laveran announced to the Academy of Sciences on April 1 the results of his experiments and search for a means to combat this disease. He reported that subcutaneous injections of human blood serum into mice infected with nagana, and having large numbers of trypanosoma in their blood, causes the temporary disappearance of the parasites from the circulation in these animals. He thought the power of destroying the parasite was possessed by the human leucocytes, for the blood plasma was inactive. Heating the serum to 52° C. for one hour caused it to partially lose its activity. Heating it to 62° C. for the same length of time still further weakened it. Some hope was therefore expressed by certain of our medical journals that the cure for this disease had been found. We had already previously tried injections of human blood into monkeys suffering from experimentally produced trypanosomiasis from injections of *Trypanosoma evansii*, but found, while the parasites disappeared temporarily, after a few days they were always again present in the circulating blood. Goat's blood and bile from monkeys that had died of the disease were also tried, but with like results. Goat's serum was used, as these animals are relatively immune to the parasite. Experiments with the intravenous injection of benzoyl-acetyl peroxide will be performed as soon as the animals for experimental purposes can be secured. The difficulty experienced in obtaining proper animals has seriously hampered the work of the laboratory throughout the year.

It seems that it is chiefly through its mechanical destruction of the red blood corpuscles that the trypanosoma causes harm. Some experiments were performed to show whether the parasite elaborated any toxic substance which acted injuriously upon its host. Large amounts of blood taken from monkeys suffering with experimentally produced trypanosomiasis of severe type were passed through a Berkefeld filter and the filtrate injected into other monkeys. No symptoms of trypanosomiasis were produced. Large celloiden capsules containing blood with many parasites were placed in the abdominal cavities of sheep, but the results were also negative.

While Laveran and Mesnil maintain that man appears absolutely refractory to the disease nagana and that human blood serum in fact will destroy the parasites, these statements must be accepted with caution, particularly as Dutton[j] has recently reported the discovery of a species of trypanosoma in man. This species resembles to a certain extent the *Trypanosoma brucei*, but was somewhat smaller than this

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[a] Emergency Report on Surra, 1902. American Medicine, February 8, 1902.

[b] Comptes rendus Société de Biologie, March 29, June 28, 1901. Comptes rendus l'Accademie de Science, July, 1901; October 28, 1901; April 1, 1902. Annales de l'Institut Pasteur, September 25, 1901; January 25, 1902.

[c] Comptes rendus Société de Biologie, May 10, 1901.

[d] Proceedings of the Royal Society of London, May 4, 1901.

[e] Zeitschrift für Hygiene und Infektionskrankheiten, March 13, 1902.

[f] Archiv für Hygiene, Bd. 42, 3.

[g] Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten, Bd. 31, 10.

[h] Journal of Pathology and Bacteriology, June, 1901.

[i] Comptes rendus Société de Biologie, vol. 12, No. 12, 1902.

[j] British Medical Journal, January 4, 11, 1902.

parasite. This is only the second instance in which a parasite of this genus has been reported in man. The first two cases were published in 1898 by Nepveu,[a] from South America. In both of them malarial parasites were also present in the blood. His description of the trypanosoma is incomplete. As yet we have met with no case of human infection in the Philippine Islands.

In regard to the treatment of surra in animals, it seems that as yet there is no cure for the malady, and in horses at least it is apparently almost universally fatal. Experiments to find some means of combating the disease are still in progress in the laboratory. Until some successful method is found, however, it would seem advisable to destroy at once all horses suffering from this disease, unless they can be strictly isolated and protected from biting insects.

RINDERPEST.

Experiments performed here have recently shown that the rinderpest of the carabao (*Bubalus kerabau*) is apparently the same variety of the disease as the common rinderpest of cattle. Indian cattle inoculated with blood taken from a carabao suffering from rinderpest have developed and died with all the symptoms of the disease. This shows the fallacy of the popular idea among many cattle dealers here that foreign cattle will not take carabao rinderpest, and that if allowed to run with an infected carabao herd they will not contract the disease. A large herd of cattle have recently been highly immunized against rinderpest, and a considerable quantity of antirinderpest serum has been prepared and is now ready for use. Experiments are also being undertaken in regard to the etiology of the disease. Appropriations to provide cattle and attendants, as well as pasturage, will be necessary to enable the Serum Institute to continue this work successfully, and to immunize imported cattle.

CONTAGIOUS LYMPHANGITIS.

A few months ago a form of pseudo-farcy was found to exist in the Philippine Islands. Following is the report made from the laboratory on June 26 regarding this malady:

PRELIMINARY REPORT OF THE APPEARANCE IN THE PHILIPPINE ISLANDS OF A DISEASE CLINICALLY RESEMBLING GLANDERS.

Veterinarians and owners of horses are advised that an infectious disease which may clinically at times closely simulate farcy (the nodular, cutaneous form of glanders) has been found to exist in the Philippine Islands. My attention was first called to this malady by Dr. J. G. Slee, veterinarian of the board of health, Manila, who sought aid from the laboratory in the diagnosis of the disease with which several horses were afflicted, and requested an examination of these animals for glanders. That this malady sometimes closely resembles the cutaneous form of glanders may be evidenced from the fact that in the first case encountered a diagnosis of farcy had already been made by three veterinarians. Upon a microscopical study of material removed from the pseudo-farcinous buds, however, it has been possible to show that the disease under discussion is of an entirely different origin from glanders. Indeed, while farcy is an affection which owes its origin to one of the schizomycetes or fission fungi (bacillus Mallei), the malady under consideration, it seems, is not due to bacterial infection at all, but to a parasite of an entirely different group, namely, one of the budding or yeast fungi (a blastomyces).

Clinical manifestations.—The disease starts as a small nodule situated in the cutis and frequently in the neighborhood of some slight abrasion. The primary node usually appears upon one of the extremities or in the cervical or abdominal region, but may be situated on the shoulders or chest. From the first nodule the infection spreads, apparently along the course of the lymphatics, and eventually many buds form. Frequently the adjacent lymphatics become swollen and arranged in a row, presenting somewhat the appearance of beads on a rosary. The nodules vary in size from about 5 mm. to 3 cm. in diameter. The hair is preserved over the younger tumors, which at first are hard, but usually soften later and form larger abscesses. If left to themselves, they generally finally open and leave ulcers with margins, which are usually irregular. When the abscesses are incised in their early stages they are found to contain a bloody, purulent, tenacious material. The contents of the older tumors is yellowish white, gelatinous, and very tenacious. When the cervical region is affected, the submaxillary glands are not uncommonly swollen, and the lymphatic

[a] Comptes rendus Societe de Biologie, December 30, 1898.

glands near the other parts involved are usually enlarged, soft, and freely movable. The disease extends gradually, and in neglected cases may spread over almost any part of the body and even invade the nasal mucosa. A mucous discharge from the nose then appears, and the picture now more closely resembles glanders. We, however, have not yet seen the primary nodule situated in the nares. In the cases observed, there seems to be no tendency for the process to invade the scrotum, testicles, or penis. Indeed, though there have been nodes very near these organs, there has so far been no involvement of them. In the fairly severe cases there may be some general disturbances, such as slight fever and loss of appetite. In the severe ones anemia and cachexia appear in addition. The mild ones may run an almost afebrile course.

While glandular metastases occur, metastases in the internal organs have not as yet been observed. Occasionally sinuses form in the subcutaneous and deeper muscular tissues. The disease runs a chronic course and may last for months, but the prognosis is usually favorable and a very large majority of the animals eventually recover. Cattle are sometimes affected with this malady, but it is not so common in these animals as in horses.

Etiology.—As has been stated above, upon microscopical examination it was very soon seen that the disease had an entirely different origin from glanders. Cover slip preparations and cultures made from many early and late nodules showed no bacteria. In a few instances micrococci were found present, but it seemed likely that these organisms had invaded the lesions secondarily from the skin, as it was particularly in the older and more superficial abscesses that they were encountered. In no case have bacilli been met with either in cover slip preparations or on the various culture media employed. In fresh microscopic preparations made from material of the nodes, while the absence of bacteria is noticeable, what is still more striking is the presence of numerous oval glistening bodies measuring from about 4 to 5 μ long by about $3\frac{1}{2}$ μ wide, and presenting a double contour. These bodies are found lying both free and inside the cells. In specimens of the pus stained with Ehrlich's triacid solution, the cells which contain the parasites are seen to be generally of two varieties, namely, large endothelial phagocytes and polymorphonuclear neutrophiles. Inside the cells these oval bodies generally appear in the hardened specimens as clear, glistening spots somewhat resembling vacuoles. Often from three to five may be seen in one cell. Frequently they do not stain with the aniline dyes. Even after prolonged treatment with carbol fuchsin, most of them remain clear, though some show a deeply staining point, which is usually placed eccentrically, or others inclose several deeply stained granules. Occassionally there is some staining at the periphery of the body while the central part remains clear. A smaller number may, however, uniformly color a fairly deep red or assume a pinkish tinge. In specimens of the pus carefully hardened at a low temperature, treated with carbol fuchsin and mounted in water, while one still finds a large number of clear ovals, many others are stained a deep red and some of an eosin color. It can not be said that the age of the blastomyces is the only factor which determines this affinity for the dye, as many young cells stain poorly, while occasionally older cells color intensely. From these preparations, however, it is easy to see that the glistening oval bodies observed in specimens hardened in alcohol and ether or hardened without certain precautions are the empty capsules of the blastomyces from which the protoplasm has in some way escaped. In the specimens mounted in water it is very common to find one or several deeply colored staining granules situated inside of the clear capsule and endowed with very active Brownian movement. We have not been successful in staining the empty capsules with the methods employed in coloring the capsules of bacteria, nor have we been able to obtain any apparent reaction with the iodine stains. Frequently there is the appearance surrounding the oval bodies of a ragged envelope which stains faintly. The capsules may be made very distinct by treating them with dilute acid or alkaline solutions.

The exudate from the nodules is very rich in cells and consists chiefly of large phagocytic cells and polymorphonuclear neutrophiles. In addition to red blood corpuscles, there are a fair number of small round mononuclear cells, some eosinophiles, and a few plasma cells. A few of the neutrophiles show iodophilia with Ehrlich's stain. The exudate also contains a large amount of fibrin.

Cultural properties of the blastomyces.—The organism does not grow well on bacteriological media, such as plain agar, glucose, maltose, saccharose, and beer-wort agar or bouillon and potato. After from seven to ten days, on glucose or wort agar, sometimes a very delicate growth may be observed along the track of the needle on the surface of the media. Cover slips show that the organism is living and slowly reproducing itself. Small portions of the material removed from the nodule and mixed with a small quantity of bouillon or agar in a hanging drop show numerous budding forms after from forty-eight to sixty hours in a moist chamber. After a

still longer time jointed hyphae may be noted, and later formations of lateral and terminal conidia. In the protoplasm of the cells may be frequently seen vacuoles and bodies resembling oil drops. No fermentatian of any of the sugars has as yet been observed.

We have been successful in producing small nodules in one monkey by subcutaneous injection of material containing the blastomyces.

Differential diagnosis.—The disease briefly reviewed above is not to be confused with that termed "Bursatte" in India, as described by F. Smith as being due to a "mold fungus," or with that known as "farcin du boeuf," an affection of cattle which exists in the West Indian islands, especially Guadeloupe, and which owes its origin, according to Nocard, to a streptothrix, or more correctly, to an actinomyces. It is, however, probably very closely related to the variety of lymphangitis epizootica studied particularly by Fermi and Aruch and to a similar infection described by Tokishige in Japan. Rivolta had previously noticed certain highly refractive bodies constantly present in the pus from nodules of cases of lymphangitis epizootica, which he termed *Cryptococcus farcinimosus*. By other observers these bodies have been considered as coccidia or as sporozoa. In the Japanese variety the scrotum penis, and testicles are particularly liable to infection, and metastases of the lungs may occur and even changes in the periosteum of the bones and cartilages. Tokishige considered a saccharomyces which he named *Saccharomyces farciminosus* to be the true etiological factor in this disease. Nevertheless it appears that his organism was rather to be classed as oidium. The organism described by Fermi and Aruch differs considerably, however, from that regarded by Tokishige as the causative agent. The former observers obtained colonies on potato cultures after three days. The cells were rounded or oval, and buds formed at the ends. Hyphae were not mentioned. Tokishige's saccharomyces required from thirty to fifty days for development on artificial media, and in time the surface then became folded like coils of the intestine. Microscopically hyphae and yeast cells occurred together.

As our organism as yet shows no tendency to ferment sugars, we prefer to consider it, for the present at least, as a blastomyces. The disease is still under study in the laboratory, and a more complete report will appear at a later date.

The diagnosis can usually be suspected and in many cases made in the following manner: A small amount of material from a freshly opened nodule should be transferred, preferably by an oese, to a glass slide and covered with a cover glass which is gently pressed down. On examination with a moderately high power (Zeiss DD, Oc. 4) numerous glistening ovoid bodies with a double contour, as described above, may be seen in the field of vision. The diagnosis should be confirmed by cultures.

Treatment.—On the appearance of the first node the hair should be shaved for a considerable distance around it, the nodule opened early, curetted, cauterized, and thoroughly cleansed with some antiseptic solution, such as benzoyl acetyl peroxide,[a] bichloride of mercury, or creoline. Applications of formalin have also given good results. A 1 to 1,000 solution of benzoyl acetyl peroxide should be injected subcutaneously completely around the early tumor with the hope of limiting the extent of the disease. As each new node appears it may be treated in like manner. The skin in the neighborhood of the tumors should be kept perfectly clean. It is advisable to thoroughly irrigate the open ulcers at least twice a day. In the interval some ointment, such as iodoform or sulphur, should be applied.

Veterinarians and owners of horses are advised before destroying animals suffering from supposed farcy to have microscopical examinations made from the nodules of the infected animals at the Government biological laboratory. It seems probable that a number of horses suffering with this disease have already been destroyed. As has been stated above, a large majority of the cases eventually recover, although the disease may persist for months.

JUNE 26, 1902.

Since the publication of this report numerous other cases have been observed. It has been found possible to convey the disease by direct inoculation from one horse to another. Therefore an intermediate host is not necessary to reproduce it, and the disease is a contagious one. The incubation period for the disease is about one month—that is, the primary lymphatic nodule becomes apparent after about this length of time from the date of inoculation.

HOG CHOLERA.

Dr. Richards, veterinarian of the board of health, was the first to suspect the presence of this disease in Manila hogs. With his assistance a number of the killed hogs were subjected to autopsy and bacteriological examination. The characteristic lesions

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[a] Generally termed "benzozone" or "acetozone."

of the disease were found and the bacillus cholerae suis isolated from the spleen and lymphatic glands of several of the cases. Fortunately the number of infected hogs here so far has been small.

Locust Fungus.

The bureau of government laboratories obtained tubes of fungus from Cape Colony and from Washington, D. C., in December, 1901, and using these as a basis it prepared cultures in large quantity, which were shipped to all of the provinces. Great difficulty was experienced in obtaining reports as to its use, and in some cases it was discovered that this means of exterminating the locusts was avoided because of the fear of sickness resulting from eating the grasshoppers destroyed by it. It will probably be some time before this prejudice can be overcome and the use of the remedy become general. Such reports as have been transmitted to this office have been encouraging, and the distribution of the cultures is being pushed as vigorously as possible.

Fungus shipped to provinces.

1901.

	Number of tubes.
October	97
November	61
December	46

1902.

January	6
May	48
June	29
July	42
August	40
Total	379

Reports received.

Date.	Province.	Report.
Nov. 13, 1901	Pangasinan	Reports use of fungus without result; believed to be on account of dry weather.
Jan. 18, 1902	Ilocos Norte	Reports that fungus is not used on account of probable danger to natives eating locusts dying from fungus disease.
Jan. 22, 1902	Albay	Reports that about two weeks after distribution of fungus all locusts disappeared from the province; dead locusts found in great numbers.
Feb. 27, 1902	Leyte	Reports use of fungus and liberation of diseased locusts in swarms; that many were found dead after the passing of the swarm, with same general appearance as those of the locusts which died in captivity of fungus disease. On account of dry season sick locusts were left behind and swarm was not destroyed.

The following letter from A. F. Dennhardt, who made intelligent use of the remedy, gives as good an indication as any of the results to be obtained:

Santa Maria de Pandi,
Bulacan Province, P. I.

Superintendent of Government Laboratories,
Manila, P. I.

Sir: I have the honor to report as follows concerning tests made with "locust fungus" furnished by the bureau of government laboratories:

1. Test unsatisfactory owing to climatic conditions and failure of foreman in carrying out instructions.

2. Test made with 100 locusts confined with one infected by dipping in preparation of the fungus. Result: Entire 100 killed within twelve hours.

3. Test made on afternoon and night of July 23. Climatic conditions: Heavy rain. Time of infection: 4 o'clock in the afternoon. Place of test: On plantation of Philippine Sugar Estate Development Company at Cupang, plantation of Pandi, Bulacan Province. Method: Eight or ten locusts were captured and released in the swarm then resting on the fields after being infected by dipping in the "locust fungus," pre-

pared according to directions sent out by the bureau of government laboratories. Result: On the morning of July 24 over thirty cavanes of dead locusts were found in the vicinity of the place where the infected locusts were released, none found in places not infected, and the remainder of the swarm had left the plantation. The last test has proved so highly satisfactory that it is my intention to follow it up with systematic work with the "fungus," not only in this province, but on the properties of the company in Laguna Province, from where I will be pleased to send you a further report.

I find that the most satisfactory time for infection is during rainy weather, releasing the infected locusts at nightfall.

Very respectfully, ANTONIO F. DENNHARDT.

OTHER MISCELLANEOUS WORK.

Owing to the fact that a case of human infection with *Balantidium coli* was encountered in Manila during the preceding year,[a] a search for the parasite has been made in the intestines of the native hogs brought here for slaughter. About 4 per cent of these animals were found to be infected with the infusorian. We may, therefore, be on the lookout for other instances of human infection. A study of the clinical and pathological significance of *Balantidium coli* has recently been pursued. The report is too lengthy to appear here, but will shortly be published elsewhere.

Experimental and clinical studies on amebic dysentery have been performed, which will also be published as a separate report.

GOVERNMENT PHOTOGRAPHER.

During the fiscal year the bureau of government laboratories purchased a complete equipment for the government photographer, Mr. Charles Martin. The work undertaken was varied. During the year three trips were made outside of Manila—one to Bangued, Abra, where the photographer joined the governor of the province, and the others with the chief of the mining bureau to the region near Angat, Bulacan. Two hundred and eighty-six views were taken. In Manila work has been done for the board of health, bureau of architecture, bureau of non-Christian tribes, bureau of forestry, and the honorable the secretary of the interior. In all about 2,200 prints have been made.

I am, very respectfully, PAUL C. FREER,
Superintendent of Government Laboratories.

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[a] Strong and Musgrave: Bulletin Johns Hopkins Hospital, February, 1901.

PHILIPPINE
GOVERNMENT
LABORATORIES

REPORT

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